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Improving Machine Changeover/Setup Times by Increasing U.S. Manufacturers' Knowledge of 5S

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Abstract

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MS, Colorado Technical University, 2005

BS, Oregon Institute of Technology, 2001

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Abstract

The 5S process is one of the techniques born out of Japanese manufacturing. Ohno, the developer of 5S, found that when manufacturing waste is eliminated, costs are reduced and profits increase. This is the bases of 5S and this research. The cost of U.S. manufactured products is higher compared to the cost of products from other global manufacturers that use 5S. This study was conducted to determine if implementing 5S in U.S. manufacturing could change U.S. manufacturing cost and if using 5S could impact U.S. manufacturing. The research questions focused on the relationship between 5S and changeover/setup times on production machines. The method was quantitative utilizing a quasi-experimental pretest/posttest design. Three manufacturing companies in Oregon made up the sample. A baseline 5S scorecard was completed recording changeover/ setup times on production machines at each of the companies. Interviews were conducted in a 30-minute training intervention on implementing 5S at each company location. Using a 5S scorecard, the waste in each company was assessed once every 2 weeks for 4 months. The number of 5S assessments varied based on the time each company location took to implement 5S. Once 5S was implemented fully, changeover/setup times for each machine were measured and analyzed using z or t statistics. Results showed a significant ($p <$ .05) decrease to changeover/setup times at 2 companies, supporting the hypothesis that 5S could reduce cost in US manufacturing. Positive social change may be possible when showing how 5S can decrease changeover/setup times providing more production time and reducing overhead cost going into U.S. manufactured products, which in turn makes them more competitive in the global marketplace and potentially brings manufacturing jobs back to the U.S.

Improving Machine Changeover/Setup Times by Increasing U.S. Manufacturers' Knowledge of the 5S

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Chapter 1: Introduction to Study

The cost of producing products is higher in the United States than in other countries (Dudlicek, 2010; Raab, 2014). Despite rising w ages in many countries (Dudlicek, 2010; Raab, 2014), employee wages are higher in the United States than in other countries (Dudlicek, 2010; Raab, 2014). This disparity is helping China and other low cost wage countries outperform U.S. manufacturers with similar or same products at lower market prices (Dudlicek, 2010; Raab, 2014). Because the cost of producing goods in countries such as China is cheaper, it is vital that U.S. manufacturers become more competitive in the global economy (Dudlicek, 2010; Raab, 2014).

One option for U.S. manufacturers may be to apply the manufacturing principle known as 5S, which was developed at the auto manufacturer Toyota in the 80's (Ohno, 1988). The term 5S comes from the first letter of words which originated in Japan and translate into 5S words in English (see Table 1). The technique is widely used in Japan and since 1990 it has become more popular globally (Dudlicek, 2010; Raab, 2014) as a way to reduce operating costs (Acharyaa, 2011; Bayo-Moriones, Bello-Pintado, & Merino-Diaz Cerio, 2010).

Table 1

Meanings of Each of the Words From 5Ss in Japanese and in English Translation

S	Japanese	English
First S	Seiri	Sort
Second S	Seiton	Set in place
Third S	Seiso	Shine
Fourth S	Seiketsue	Standardize
Fifth S	Shitsuke	Sustain

Note. Adapted from *Visual systems: Harnessing the power of a visual workplace* (p. 57), by G. Galsworth,1997, New York, NY: United States Management Association.

In addition to increased efficiency and reduced waste, 5S provides manufactures with a base to implement lean manufacturing (Bagi & Rascle, 2013; Rotaru, 2008). 5S can be used to organize the workplace and make the workplace easier to manage (Dudlicek, 2010; Raab, 2014). An organized workplace is necessary to implement and successfully run lean manufacturing (Jones & Womack, 2003). Lean manufacturing is about doing more with less; less encompasses human effort, space, equipment, and time (Galsworth, 1997). Doing only value added work with a smooth flow while delivering what the customer wants when they want as the best quality product at the lowest possible cost (Brandt, 2015; Womack, Jones, & Ross, 2004).

Using the manufacturing principles of lean manufacturing and 5S could improve U.S. manufacturing competitiveness in the global economy (Liker, 1997). Which is why I chose this particular study, wanting to show U.S. manufactures a potential way for increasing their competitiveness in the global economy. If waste is removed in manufacturing processes, less overhead goes into making a product and the time to fill a customer order decreases. This can decrease the cost of the finished good to customer and improve U.S. manufacturing competitiveness in the global economy (liker, 1997).

Background of the Study

Corporations use 5S for varied, but similar, purposes. Companies such as Toyota use lean to facilitate the teamwork of continuous problem-solving (Liker, 2004). “In the Toyota Production System (TPS), 5S helps make problems visible and can be part of the process of visual control of a well-planned lean system” (Hirano, 1996, p. 5). Boeing uses 5S as a “tool for safety process improvement” (Ablanedo-Rosas, Alidaee, Moreno, &

Urbani, 2010, p. 7064). Ford, Metaldyne and Toyota also use 5S to improve safety through good housekeeping that improves employee effectiveness, attitude, and efficiency (Carter, 2003; Edwards, 2015). These are just some of the companies worldwide that use 5S.

According to Ohno (1988) and Caloska, Donev, Gecevska, and Jovanovski (2015), several researchers have studied Japanese manufacturers' use of 5S. However, in my review of the literature, I was able to find only two such studies that had been translated into English (Ohno, 1988; Shingo, 1981). Researchers in the U.S. (Hutchins, 2005; Lynch, 2005), Spain (Bayo-Moriones, Bello-Pintado & Merino-Diaz do Cerio, 2010; Caro, Marmolejo, Mejia, Rojas, Vergara, 2016), Malaysia (Ghodrati & Zulkifli, 2013), and India (Deror, Jun, & Mohd, 2012; Rojasra & Qureshi, 2013) have studied the effects of 5S on manufacturing in their respective countries. These works all show how 5S can help a company improve safety and decrease cost of manufacturing operations. More recent research on improving safety and house cleaning with 5S have begun to appear (Camargo, Z., Hernadez, J., & Sanchez, P., 2015; Casey, 2013; Semiklose, 2014).

In this study, I examined the effect that 5S may have on production productivity in U.S. manufacturing. Specifically, I studied whether 5S affects production machine changeover/setup time; does implementing 5S increase or decrease changeover/setup times. According to my literature review this has not been studied by other researchers. I conducted my research in companies that had full support from their management for implementation of 5S. Hutchins (2006) and Lynch (2005) studied companies that did not have this buy-in from management. That aspect negatively impacted their results as both these researchers felt management interfered negatively with the efforts to properly implement 5S.

Problem Statement

Because U.S. manufactures lack competitiveness in the global economy, there has been a push from senior management in U.S. manufacturing firms to increase competitiveness over the last 20 years. The push is to increase competitiveness by implementing things that are used in other countries to reduce costs like 5S and lean manufacturing (Shipulski, 2008). The general problem addressed in this study was the lack of knowledge about the usefulness of 5S when applied in U.S. manufacturing. From what I could find, little research has been published on the outcomes of U.S. manufacturers' application of 5S. I could only find two studies that had examined possible production changes due to the implementation of 5S among U.S. manufacturers (see Hutchins, 2006; Lynch, 2005). Based on this lack of research, I surmised that few U.S. manufactures use 5S for production improvements. Kobayashi and Fisher (2008) stated that the lack of 5S use in the U.S. might be related to the limited published empirical evidence on the use of 5S in U.S. manufacturing. Because of this, U.S. manufacturers may be missing out on 5S, something that may help make them be more competitive in the global economy.

Purpose of the Study

The purpose of this study was to determine if increased understanding of 5S translated into a change in production machine changeover/setup times when 5S is used in U.S. manufacturing and if any change is statistically significant. Whether a change is found or not this research will also serve as a guide to indicate if a field study of greater breadth and depth should be done. This field study would be to test the theory of Ohno in U.S. manufacturing and determine if the use of 5S does reduce manufacturers cost. A full

study would also help close the gap that is lacking in the literature on results of implementation of 5S in U.S. manufacturing.

The design for this study is a quantitative pre-experimental design called a one-group pretest-posttest. A pre-experimental design was selected because I could not find any companies to use as control group. In addition, I selected a quantitative approach with a one-group pre-post design because with this approach I can use statistical analysis to test my hypothesis. The independent variable for this study is 5S scores. Dependent variable is changeover/setup times on manufacturing production machines.

Research Question and Hypotheses

The research question for this study was, does the implementation of 5S result in a change in production machine changeover/setup times for manufacturers? The null and alternative hypotheses were

H1: The use of 5S methodology does not change the changeover/setup times on manufacturing production machines in a way that is statistically significant.

H0: The use of 5S methodology does change changeover/setup time on manufacturing production machines in a way that is statistically significant.

Theoretical Foundation

As with Lynch's (2005) study, this study was based on the work of Ohno who theorized "elimination of waste in a manufacturing facility will reduce costs, thereby increasing profits, perhaps by a factor of ten" (Ohno, 1988, p. 3). Ohno's theory is, as follows: if a manufacturer decreases waste, which in manufacturing includes waste of time, materials, product scrap, and other functions, then the time from when an order is received to when it is shipped can be decreased. Decreasing overall manufacturing time of a product will decrease overhead costs that go into its manufacturing. Ohno developed

this theory based on his studies of Toyota with Shingo (Ohno, 1988). Together, Ohno and Shingo developed 5S (Ohno, 1998). They first used 5S to facilitate the elimination of waste in manufacturing at Toyota, which resulted in their creation of the Toyota production system.

In the first English language writing on Ohno and Shingo's efforts, Shingo (1981) identified eight types of waste in manufacturing: defects, overproduction, waiting, not properly utilizing resources, transportation, motion, excessive processing, and excessive inventory. The first type of waste is defects, which includes making bad parts, having scrap, the wrong information, or having to rework a part. A second type of waste is over production or making more products than needed for the next step in the process. A third type of waste is waiting which occurs when materials, information, machines, and approvals are not ready when needed. Waste type number four is not properly utilizing resources, has three components. Component one is wasting production time by not using the most effective piece of equipment for the task. Not using the most effective piece of equipment for the manufacturing process wastes time by creating longer processing times as opposed to what the processing time could be by using the most effective piece of equipment. The second component of resource waste is not utilizing employees' talents where they are most effective or productive. People must be placed in jobs in which they will be most effective. However, when placing employees in their most effective position, one should ensure that they are also the most productive persons for the position. If not, this will create the final of the three resource waste components; the waste of not using the most effective person for a job. Manufacturing production is a balancing act between choosing the right equipment for the process, having the right employees and putting the right people in the right job. Waste type five is transportation.

Transportation involves movement of materials and products in the most efficient way. Inefficient movement of materials and products wastes time that might be used for other tasks or simply shortening overall time to produce a finished product. The sixth type of manufacturing waste, excessive inventory, is any excess product inventory in an area other than what is needed for effective operation or repair of a machine. The seventh type, motion, is any movement that does not add value to the product process step. Nonvalue motion is movement of products or employees that do not contribute to the final finished product. Finally, the eighth type of manufacturing waste is excessive processing. Excessive processing encompasses activities that do not add value to the product. Activities that do not add value as order by customer could include, making a part higher quality or more complex than ordered by customer which wastes time by requiring more processing than required of the part as ordered by customer.

According to Ohno (1988), the purpose of 5S is to aid manufactures in the removal of the eight types of waste. 5S has two main impacts in removing these wastes that could affect the length of time it takes to do manufacturing production machine changeover/setups. The first way 5S is used to remove waste is with better organization throughout the company. In 5S, each item in the plant has an easily identifiable home, which is located as close as possible to where the item is used most frequently. To maintain order, an item must be returned to its home after its use so that it can be easily found when needed. Having tools and parts in an easily found, known location each time could reduce the amount of time wasted looking for parts or tools needed to do a machine changeover/setup. Additionally, 5S cleans up clutter and result in a workplace that is easier to move around and work in (Jaca, Mateo, Paipa-Galeano, Santos, Viles, 2014)

The second way 5S may affect manufacturing machine changeover/setup time is through keeping tools and equipment in good working order through cleaning to inspect. 5S stresses only keeping good working items in the facility and doing regular maintenance on them to ensure they stay in operating condition. Cleaning to inspect is looking for problems with broken or potentially broken tools and equipment, which are then addressed immediately, instead of simply cleaning to clean. This includes removal from the facility, which, as with better organization, also helps eliminate clutter and could result in a workplace that is easier to move around and work in (Ohno, 1988). In chapter two, I provide a detailed discussion on the steps in 5S implementation and maintenance.

Additionally, this study is based on the works of seven research studies done in other countries. In Spain (Bayo-Moriones, -Pintado & Merino-Diaz do Cerio, 2010; Malaysia Ghodrati & Zulkifli, 2013; Carvalho, 2015; Caro et al., 2016), and in India (Deror, Jun, & Mohd, 2012; Deshmukh, Garg, & Upadhye (2010); Rojasra & Qureshi, 2013) have studied the effects of 5S on manufacturing in their respective countries. These researchers all found that the use of 5S in manufacturing, in their respective countries, had a positive impact on manufacturing in one way or another. These works are a major inspiration for this study. If I show a statistically significant change in time for production machine changeover/setups, I will accomplish a goal for this study. That goal is to show enough of a change to merit a field study of greater breadth and depth. In turn, the field study may lead to confirming the value in reducing costs for U.S. manufacturing when 5S is implemented.

Nature of Study

The design for this study was quantitative pre-experimental design called a one-group pretest-posttest. A pre-experimental design was selected because I could not find

any companies to use as control group. In addition, I selected a quantitative approach with a one-group pre-post design because with this approach I can use statistical analysis to test my hypothesis.

To recruit participants for this study I had an e-mail message sent out through the Portland, Oregon chapter of the Society of Manufacturing Engineers requesting participants. I got seven replies from companies willing to participate as part of the experimental group. I called, talked to each, visited four and selected three that were good fits for this study. However, I got no contact from companies willing to be part of the control group so I had to settle on the pre-experiment design.

The independent variable for this study is 5S scores that are evaluated and collected using a 5S scorecard. Dependent variable is changeover/setup times on manufacturing production machines. I used a stopwatch to collect changeover/set times. I collected both data before training treatment and after treatment.

After data collection was complete, I then computed the mean of the pre and post dependent data. According to Coolican (2013), if the sample size, I am able to obtain in my data collection, comes out to be less than 30 a t-test can be used to determine if any change in means between the pre and postproduction machines data changeover/setup data is statistically significant. If the sample size collected is more than 30, a z-test can be used to analyze the means to see if any change in mean between pre and post data statistically significant. I used the t-test at companies A and C. While at company B, I was able to get more than 30 samples. I used a z-test to analyze the data. I performed all the calculations using Excel and SPSS.

Definitions

Hawthorne effect: "Situation where [research] participants' behavior is affected simply by the knowledge that they are the focus of an investigation and are being observed" (Coolican, 2013, p. 95).

Mass production (or, traditional manufacturing): A method of manufacturing products on large scales where efficiency is a result of direct labor outputs (Rubrich & Watson, 2004).

Muda: Any activity related to manufacturing a product or providing a service that is the waste or a non-value added activity (Dennis, 2007).

Assumptions

For this research, I chose companies that would, to the best of their ability, ensure participation of all employees in the research. This was done by selecting companies that made it known to their employees that participation in the 5S efforts was an expectation. Managers supported employees' participation throughout the duration of the study. Therefore, the assumption was that all employees, in each participating company, participate without sabotaging the study. This was important because I could not be at each participating company every day to see if employees at each company were participating without sabotaging the study.

I also assumed that with my provided training and help on the first iteration of 5S, participants would implement 5S properly, and each eventually did. This assumption was also needed because I could not be present at each company every day to observe if 5S was being implemented properly. Implementing and continual monitoring and improvement is something each company was expected to learn and do on their own as

part of this study. In this way, the hope was that they would be able to maintain their 5S implementation after I had completed the study.

Another assumption was that senior managers would hold true to their promise that no other treatments will be applied to the company until my 5S research is complete. This assumption was made because other treatments applied to the company during this study will make it difficult to tell if the results of this study come from 5S implementation or other intervening treatments. Once again, I could not be at each company every day to make sure this does not happen. Companies held true to their word here and no other treatments were applied at any of the participating companies during the duration of the study.

Scope and Delimitations

I started by conducting two audits at each of the three companies participating in the research. These audits included an initial 5S audit and a pre-intervention time study of the manufacturing production machines, which have changeover/setups, at each of the three companies. At the sunglasses manufacturing company, there were two machines with changeover/setups to measure. At the plastics company, there were seven machines. There was only one machine at the wood moldings company. I conducted audits for each of these machines.

First, I conducted a 5S audit using a form obtained from the company Enna to rate the participating companies on each of the elements of 5S. On the same day the 5S audit was done, I also measured production machine changeover/setup times on each of the production machines, previously mentioned, at each of the companies. The purpose was to obtain a baseline for each company's current 5S status and times for changeover/setups prior to 5S training and implementation. The number of changeover/setups measured was

unknown at the time of starting this research and depended on the mix of the products being run on the day of data collection. The production mixes and order sizes running at each company were such that changeover/setups had to be collected over a number of weeks to obtain even a small number of data points to try to answer the research question. Data on changeover/setup times was small at some companies despite spending three weeks on pre-treatment data collection and even more at some companies in post treatment.

A delimitation for this study existed. The population for the study was restricted to companies in the cities of Portland Metro and Salem Oregon. The reason for this was to make the research financially feasible for me. Each of the participating company's location was such that I could drive to the research sites, conduct the research, and then back home in the same day. Money was not available for any other option.

Limitations

One limitation was that the population and samples were restricted to manufacturing companies in the Salem and Portland Metro cities of Oregon. There could have been a Hawthorne effect since I had to be visible on the shop floor while obtaining the data. The act of being visible to those performing machine changeover/setup times being measured, could have changed the way they performed. Thus, the results might have differed from what they would have been if I were not visible. However, there was no way for me to avoid a possible Hawthorne effect as it was necessary to be close to the action while collecting data to have a clear view, obtain accurate measurements, and be visible to participants.

Another possible limitation was training. If the training was not sufficient for the participants to learn 5S, a company may not have implemented it properly. However, this

was avoided because, as I personally observed, all three companies did implement 5S fully. A final limitation was that the results of this research are not generalizable to other companies because a random selection was not done, and the three companies cannot be construed as representative of all companies in U.S. manufacturing or even all companies in the region from which they were drawn.

Significance of the Study

I chose this research topic for two reasons. First, I have worked in a couple of Asian manufacturing companies in the U.S. as well as U.S. manufacturing companies. Working for the Asian companies I have seen, what I consider, exemplary implantations of the practice of lean manufacturing. while the U.S. companies all had failed attempts at 5S. 5S is the foundation for lean as well as a part of the lean philosophy of continuous improvement

Second, what I have learned from the U.S. manufacturing companies is the response we tried 5S, and it cost us money without any of the expected results. Not an unusual answer for a U.S. manufacturer. According to McSweeney, Taylor, and Taylor (2013) as well as Bhasin (2011), and Dombrowski and Mielke (2014), westerners have not grasped the true nature of 5S and lean implementation which results in the negative attitude.

From my work experience, at a number of different U.S. manufactures, I have seen the lack of ability to understand 5S and lean fully by U.S. companies first hand. Each of the different U.S. manufacturing companies I have worked for had failed 5S and lean attempts. I looked into each of these from old records and interviews with employees who were part of the initiative. What I found is twofold. First, there is a tendency not to fully understand 5S and lean manufacturing principles as an ideology and not just a way

to focus on waste reduction. Second, there is a lack of the continuous improvement cycles needed in 5S and lean to keep the companies receiving benefits once both 5S and lean have been implemented. 5S and lean are not merely house cleaning, as any of the more recent articles on 5S seem to think (Bajaja, Kamar, & Sidhu, 2013; Edwards, 2015; Fisher, Gapp, Kobayashi, 2008;). 5S is a principle as well as philosophy that must be continually worked on to see positive results to the manufacturing bottom line.

Significance to Practice

The results of this study are significant to U.S. manufacturers to indicate the value of 5S in possibly reducing production machine changeover/setup times. If the use of 5S changes production machine changeover/setup times, in a way that is statistically significant, it could also change overall manufacturing productivity and provide a chance for increased profits. However, this research does not tell U.S. manufacturers if the change is in an increase or decrease to production machine changeover/setups. This research did not have a control group. Without a control group all that can be determined is if there is a change in production machine changeover/setup times after a treatment and if the change is statistically significant. This pre-experiment is to serve only as a guide to indicate if a full field study is worth the time and money. The pre-experiment would indicate a full field study is worth the cost and time of conducting if the results show a statistically significant change between the means of pre and post 5S production machine changeover/setup times.

The purpose of this field study was to test the theory of Ohno, which suggests implementing 5S reduces manufacturing cost and if that holds true when implemented in U.S. manufacturing (Ohno, 1988). Ohno's statement is well researched in countries other than the U.S. The results of this study help to close the gap that is lacking in the literature

on results of implementing 5S in U.S. manufacturing. It provides more literature to help get the word out to U.S. manufacturing companies letting them know if 5S is something they should be using or not. If results are positive, hopefully someone will follow with a full field study that has an experimental and control group.

Additionally, there is currently very little research on the benefits or drawbacks of using 5S in U.S. manufacturing, especially that which is specifically generalizable to the larger population of all U.S. manufacturing. Researchers studying the use of 5S in manufacturing that currently exist only studied one specific company. A population of one company is not enough to make a study that is generalizable to all of U.S. manufacturing. A full field study, if warranted, would be done with a large enough population to make it a generalizable study.

Significance to Theory

This pre-experiment is significant to the theory of Ohno (1988) who suggested that the implementation of 5S in manufacturing would reduce manufacturing costs. Here Ohno was speaking in general terms about cost savings possible in any manufacturing firm and not specifically in the U.S. where his theory has not been adequately tested. This research is significant in that it can be an indicator telling if a full study is worth the time and cost to test Ohno's theory in U.S. manufacturing. The pre-experiment would indicate a full field study is worth the cost and time of conducting if the results show a statistically significant change between the means of the pre and post 5S manufacturing production machine changeover/setup times. If I was able to show a statistical significance between the means, it is a step in supporting Ohno's theory. However, this is only one-step in the testing of Ohno's theory in U.S. manufacturing. A full field study would be needed to provide a stronger test.

Significance to Social Change

The research impact of positive social change is highlighted by advancing U.S. manufacturers' knowledge of 5S. 5S has the potential for increased profits and is a benefit for manufactures, and all of the U.S. An Increase in profits helps drive a healthier economy. Increased profits and an overall healthier company could also lead to greater employee satisfaction. In turn, this could lead to greater employee participation in 5S, even more manufacturing sector profits, and be an even stronger driver of the U.S. economy. This would make U.S. manufacturing more competitive in the global economy.

Summary

This chapter contained information about the background for this study, the problem, purpose, research question/hypothesis, and theoretical foundation. It also included insight into the nature of the study, assumptions, and other important information needed to gain a basic understanding of the focus of this study and its necessity. Chapter 1 also gave some information relating to the theory I have based this research on. Further, 5S and lean were introduced without much detail on what they actually are. Greater detail about 5S and lean, as well as their relationship, is described in chapter 2. Chapter 2 contains the literature related to 5S and lean. The first half of this chapter covers 5S as well as lean manufacturing. The second half of this chapter includes some of the positive and negative results reported in research to date on the use of 5S and lean in different industries, countries, and companies.

Chapter 2: Literature Review

The literature chapter begins with restating the problem and purpose of this research. Next, I explain what the 5S's are. Following this, an essay on lean manufacturing which starts with a history on lean which includes Deming's 14 points, as well as the 14 points which make-up the Toyota way of production. After this an investigation of the difference between traditional manufacturing and lean manufacturing is done. An examination of the composition of lean and the role of 5S in lean follows. This essay on lean also includes reporting the benefits achieved by U.S. manufacturers from the use of lean. I also consider the drawbacks of lean in this review. Next is a look at barriers and aids to implementing lean in manufacturing. Chapter 2 ends with a review of research on lean and the six in English, existing research works on 5S. The literature chapter begins with restating the problem and purpose of this research. Next, I explain what the 5S's are. Following this, an essay on lean manufacturing which starts with a history on lean which includes Deming's 14 points, as well as the 14 points which make-up the Toyota way of production. After this an investigation of the difference between traditional manufacturing and lean manufacturing is done. An examination of the composition of lean and the role of 5S in lean follows. This essay on lean also includes reporting the benefits achieved by U.S. manufacturers from the use of lean. I also consider the drawbacks of lean in this review. Next is a look at barriers and aids to implementing lean in manufacturing. Chapter 2 ends with a review of research on lean and the six in English, existing research works on 5S.

There has been a push from senior management in U.S. manufacturing firms to increase competitiveness in the global economy since the start of the 21st century (Baker, 2015; Chowdary & George D, 2011). The push is to increase competitiveness by

implementing concepts like 5S and lean manufacturing that have been used in manufacturing in other countries to reduce costs (Laosirhongthong & Rahman, 2010). The problem addressed in this study is that, according to my review of the literature, researchers have not sufficiently studied the usefulness of 5S when applied to improving specific functions such as changeover/set up times on manufacturing production machines. Having studied manufacturing and worked for several different manufacture for over 20 years I know that time is often lost during the changeover/setup. It was important to me to determine whether using 5S helps shorten it. The purpose of this study was to determine whether increased understanding of 5S translated into a change in production machine changeover/setup times among U.S. manufacturers.

Literature Search Strategy

This chapter contains current studies of 5S as well as seminal works on 5S and lean manufacturing. My literature search had two phases. The first step was a search of the online databases ProQuest and Thoreau, which I accessed via Walden University Library. I searched for works on the topic of *5S*, *5S manufacturing*, and *lean manufacturing*. Also included in this was a search for dissertations done at Walden as well as other schools on these topics. All of these searches provided me with an idea of what direction to research for further information gathering based on the information turned up in each search.

The second phase was a review of scholarly journal articles from Google Scholar and books from Amazon.com on the topic of *5S*, *lean* and *manufacturing*. The scope of the number of years I went back in time to find research and works on these topics was not limited to any specific date. 5S and lean has been around for +3 decades in Japan and

other countries, it has only recently been started to be studied in the U.S. as my search for existing works revealed.

Theoretical Foundation

As with Lynch's 2005 study, this study was based on the work of Ohno who theorized "elimination of waste in a manufacturing facility will reduce costs, thereby increasing profits, perhaps by a factor of ten" (1988, p. 3). Ohno's theory is, as follows: if one decreases waste, which in manufacturing includes waste of time, materials, product scrap, and other functions, then the time from when an order is received to when it is shipped can be decreased. Decreasing overall manufacturing time of a product will decrease overhead costs that go into its manufacturing. Ohno developed this theory based on his work at Toyota with Shingo. Together, out of their work in manufacturing, they developed 5S. They first used 5S to facilitate the elimination of waste in manufacturing at Toyota. Out of Ohno and Shingo's work at Toyota also came the Toyota Production system (Gupta & Jain, 2014). The first writing published in English on this work was Shingo in1981, in which he identified seven types of waste in manufacturing previously addressed in Chapter 1.

Ohno's theory on waste reduction was chosen because it is the underlying assumption Ohno and Shingo used for the development of the manufacturing principle of 5S, which I wanted to try to understand and help convince a wide breadth of U.S. manufactures to implement 5S. This is important to this study because I am focusing on reduction in manufacturing waste in assessing whether implementation of 5S reduces costs. My original goal was to find out whether implementing 5S, which works to reduce manufacturing waste (Ohono, 1988), would increase manufacturing companies' profits.

However, because of the lack of a control group, I could not fully test this idea. Therefore, I reduced my research to a pre study to find out if implementing 5S in U.S. manufacturing would cause a change in changeover/setup times on manufacturing production machines. My original thought was that this change would be a decrease due to reduce time spent looking for things needed to do the changeover and moving around waste when doing a changeover/setup on production manufacturing machines. Reducing the changeover/setup times would provide more uptime for production. In turn, this would provide for more throughput and profit from shortened production order run times to fill customer orders. This would then mean reduced overhead like employee wages and utilities cost that go into a customer's order that are hard or impossible for a company to control. After not finding a control group, I shifted my focus to testing whether production manufacturing changeover/setup times changed significantly after 5S was implemented.

Literature Review

The 5S's

The first step in 5S is sorting the workplace. Sorting the workplace involves identifying all needed items in the workplace and the use level of each item and, then, sorting these items by their use level. Sorting refers to identifying what employees need and do not need in the workplace to do their job and keeping only what tools, parts and equipment are needed in the workplace. The goal of sorting is to remove any un-needed items in the workplace. Sorting helps create a place of work which is less cluttered and may be easier to move around and work in (Jimeneze-Marcel, Motwani, & Ptacek, 2011; Markovitz, 2012; Moulding, 2010;Raghuram, Saleeshya, & Vamsi, 2012).

After sorting the workplace, the next step in 5S is to set in place. Set in place involves taking tools and equipment, as identifying by use level in the sorting step, and placing them by their use level in an easily identifiable home. For example, the tool or material used on a piece of equipment, or for a task, that is used the most gets placed in the location closest to the point of use first, followed by the second most used items and such. The goal is to create a home, as close to the point of use as possible where items are arranged according to how often each is used, and then is returned to after use. Setting in place makes items easier to find, saving the time of having to search for items (Jimeneze-Marcel et al., 2011; Moulding, 2010; Markovitz, 2012).

Shine is the third step in 5S. Shine includes cleaning the workplace, making sure the workplace is well lit, and keeping tools and equipment in good working order through cleaning to inspect. Cleaning to inspect is used to look for problems with broken or potentially broken tools and equipment, which are then addressed immediately. Additionally, creating a clean and well-lit workplace, which makes it easier to inspect and see problems with products and machines (Jimeneze-Marcel, et al., 2011; Moulding, E., 2010; Morkovits, 2012; Raghuram et al. 2012).

Standardize follows shine and includes using best practices to create standards that guide employees on how to best perform activities. When work is standardized, a written set of instructions is created for every job in the company. Standards make it easy for employees to do their job with little or no training, correctly, and repeatable each time. Having standards also makes it easier for any employee to step into a different job and cover for another when needed. It also eliminates the problem of everyone doing things a different way and gets them doing tasks the same most efficient way. (Markovitz, 2012; Raghuram, Saleeshya, & Vamsi, 2012).

Sustain is the final 5Ss. Sustaining is used to maintain the efforts of the previous 4Ss, and sustaining audits are performed using a 5S audit form. Through the previous 4Ss an environment is made where anyone, can easily audit another workplace area for of performance of the prior 4Ss (Jimeneze-Marcel, *et* al., 2011; Moulding, E., 2010). Upon completion of the 5S audit, the cycle circles around to the first of the 5Ss making use of the 5S audit form results to guide the company through the next cycle of 5S. An example of the 5S audit form can be seen in Appendix F.

Lean Manufacturing

Research on 5S in English and on 5S in U.S. manufacturing especially is quite limited. The bulk of what exists in the U.S. has been focused only on the benefits of 5S without any research support. There are few books in English on the topic of 5S (Jimeneze-Marcel, et al., 2011; Moulding, E., 2010; Morkovits, 2012; Raghuram et al. 2012). Some of the articles on 5S are (Deros, Khamis, Mahmood, Rahman, & Zain 2010; Goforth, Hodge, Joines, 2011; HungLing, 2011; Ramis-Pujoil & Suarez-Barraza 2012, to name a few) and conference proceddings (Clay, Glenn, Hold, Lucas, 2010; Lixia, 2008; Fetterman & Friend, 2013). Even less U.S. manufacturing research work exists (Hutchins, 2006; Lynch, 2005; Srinavasan, 2010). In addition, the majority of the writing that does exist is on lean manufacturing rather than on 5S or done in countries other than the U.S.

5S is part of the base for lean manufacturing and must be done before implementing lean manufacturing, therefore, linking them (Feighter, 2003; Jusko, 2002). Because of the link between 5S and lean manufacturing and very little research in English on 5S in U.S. manufacturing, I will cover both 5S and lean manufacturing principles in this review. I will also review existing research in English, on lean as well as 5S.

History

Stragtegos (n.d.) and Mehok (2012) called lean manufacturing a buzzword derived from the Toyota Production System. However, lean manufacturing is more than a buzzword. Lean manufacturing is a real manufacturing concept. The goal of lean manufacturing is to provide customers high-quality products, at the lowest cost, in the shortest production cycle time, through identification and elimination of waste in manufacturing processes (Gomes, Lopes, Vaz de Carsalho 2013; Newcomer 2012).

In the 1800s, manufacturing was based on individual technologies where products moved from discrete process to discrete process at random locations through the factory with workers often doing more than one task. Henry Ford developed the first real manufacturing strategy in the early 1900s. Ford's manufacturing strategy was the first assembly line. In an assembly line, each person has one specialized task and instead of parts moving randomly throughout the factory parts move on a predetermined path through a fixed set of processes. For his work, developing the assembly line, Henry Ford is considered as the father of Lean Manufacturing (Peskin, 2003).

The end of World War II left the Japanese devastated by the nuclear bombs and needing to rebuild its industrial businesses. For rebuilding, the Japanese studied U.S. manufacturing and Ford in particular. At the same time, Japan brought in Dr. Deming as part of the economic and scientific group to aid in rebuilding Japan's industrial business. In Japan, Deming used the 14 points he had developed out of studies at Ford and other companies. In these 14 points, Deming stressed the need for change in the philosophy of how manufacturers conducted business, including making leaders and not managers. Instead of working just to create products as the goal of manufacturing Deming stated,

organizations should strive to provide jobs that continually produce the highest quality products possible through continuous improvement (Deming, 2000).

To achieve this Deming recommend that product quality not be something achieved by inspection of each individual product. Instead, quality is something built into the product. Quality of a product should be made a part of every employee's job. Drive out employees' fear of management and their employer while encouraging all to care about the quality of the products of the company. Furthermore, giving employees the training they need to understand quality, feel confident about their abilities, and help them to do their best work possible. More quality is built into the product when everyone works not only to improve the manufacturing processes that create the company's products, but also work to improve all of the company's processes. Additionally, Deming stated that things such as slogans, numerical quotas and numerical goals should be eliminated. These tie employee's minds to goals other than what should be the company's highest goal: achieving zero defects (Deming, 2000).

One of the main and biggest adopters of Deming's philosophy was Eiji Toyoda and Kiichiro Toyoda, who employed Taiichi Ohno and Shingeo Shingo. Between 1949 and 1975, Toyota employees Taiichi Ohno and Shingeo Shingo began incorporating and improving Ford's manufacturing strategy along with Denning 14 point into Toyota's manufacturing, which has become known as the Toyota Production System. Two of the manufacturing concepts that came out of the Toyota Production System are 5S and lean manufacturing (Jones, Roosm, & Womack, 1990; An, 2015; Bhardwaj, Sharma, Shudhansu, 2012).

Toyota engineers noticed that there was a lot of idle time on production machines while operators waited for parts or materials needed for the machine to run. A lot of

wasted people and machine time was being created waiting for machines to be operational. Engineers focused their efforts on identification and elimination of machine downtime, as well as other forms of waste in all manufacturing processes (Ciarniene & Vienazindiene, 2013). From this work came the 14 principles of the Toyota way, which formed the basis of the following lean manufacturing principles.

Both lean manufacturing and the Toyota way focus on maximizing efficiency of production through continuous improvement. The Toyota way starts with creating the philosophy of a long-term view on company operations even if that means sacrificing things such as financials in the short term. To create a continuous improvement environment Ohno and Shingo suggested working towards the zero defects that Deming pointed to as the goal of manufacturing. Working toward zero defects is not only with products, but also any process in the company is critical. Dealing with problems is the responsibility of all employees from the president to machine operators, and all are empowered to stop production to solve problems as soon as discovered.

Every process in the company is standardized and put in writing to avoid problems. This way every employee has easy access to standardized job instructions or product inspection specification. The use of visual control is a must as that makes it easy to identify when something is not correct. When something is not correct, those that are responsible for correcting the problem must see it first-hand, setup a workstation at the problem and stay there until the problem is resolved. In the process of problems solving, problems are solved slowly and methodically by group consensus with consideration for all resolutions of the problem. In this way, the identified problem(s) are solved right the first time and can be avoided in the future.

People are also important to the Toyota way. Employees are developed into leaders and leaders developed to be experts in their job and live by the rule of teaching others their expertise. This way the company becomes a learning organization, continually working and learning how to achieve zero defects. People working toward zero defects through continuous improvement are the core of Toyota's operating philosophy.

Lean versus Traditional Manufacturing

Traditional manufacturing is defined by people such as Rubrich and Watson (2004) as a manufacturing system that works to measure efficiency because of direct labor outputs. Attributes of traditional manufacturing include keeping all machines running to produce parts without consideration of current customer orders, waste, or inventory levels. Things such as rework and scrap are considered a normal part of doing business. The prime directive of manufacturing managers is to produce direct labor hours through production of parts and products. In this model, low laborer wages are necessary for survival of the traditional manufacturing business to make up for the high product scrap that usually comes with it. Tradition manufacturing is typically an autocratic management style, which tends to beat down employees and provides no outlet for employees to be creative or feel empowered to want to perform at their highest levels (Rubrich & Watson, 2004).

Achanga (2006) referred to lean manufacturing as a cost-reduction mechanism, but that is more of a side result of implementing lean manufacturing than the goal. Lean manufacturing is an adaptation from mass production, which empowers employees to be more flexible and efficient in the work environment and all processes that are a part of a

product value stream (Groover, 2000). Shown in Table 2 is a summary of the differences between mass production and lean.

Table 2

Comparison of Lean Production and Mass Production

Mass production	Lean productions
Inventory buffers	Minimum waste
Just-in-case deliveries	Minimum inventory Just-in-time deliveries
Acceptable quality level	Perfect first-time quality
Taylorism	Worker teams
Maximum efficiency	Worker involvement Flexible production systems
If it ain't broke, don't fix it	Continuous improvement

Note. From "5S Workplaces: When Safety and Lean Meet," by Groover, 2000, *EHS Today, 5(6)*, p. 834. Copyright 2000 by Groover. Reprinted with permision.

Composition of Lean Manufacturing

Lean manufacturing has many elements associated or encompassed in its strategy one of which is 5S. As shown in figure 1, the basis for a lean manufacturing approach is a strong foundation built in part with 5S as part of that base and inside the heart as part of the lean continuous improvement strategy (Gondne, Khedkar, Mahantare, & Thakre, 2012). All of these elements are aimed at what has become the main goal of manufacturing today; that is providing customer products with the highest quality in the shortest time, while continually working towards zero defects. The other principal elements of lean in the stability foundation are standardization, just-in-time, involvement, and jidoka (Dennis, 2007; Ohno, 1988).

The stability foundation is about employees' involvement in 5S, automation (jidoka), total predictive maintenance (TPM), and production smoothing (heijunka, and kaban). Stability starts with stable employees, stable materials supply and flow, stability in manufacturing process and manufacturing supporting processes, as well as stable machines. In a stable manufacturing environment, standards for work processes are set as the core of stability with strict adherence to these standards. Surrounding the core is the visual management element of 5S. Visually, 5S supports both the standards of work methods and TPM of Machines (Dennis, 2007; Guan, Y., & Liao, 2014).

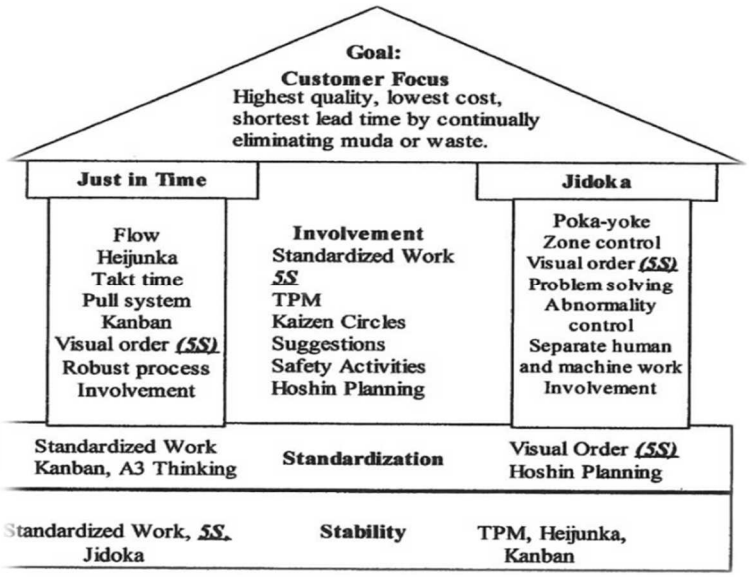

Figure 1. Composition of the lean house comprising elements of the lean manufacturing system. Reprinted from *Lean production simplified* (p.19), by P. Dennis, 2007, New York, NY: Productivity Press. Copyright 2007 by P. Dennis. Reprinted with permission.

TPM is maximizing the effectiveness of machines and equipment throughout the life of the equipment with proper maintenance and prediction of failures to avoid unscheduled down time as much as possible. TPM is critical to the stability of lean because it involves production workers in the basic maintenance, cleaning, and inspection as the first line of defense in machine inspection maintenance. Involving production

workers is significant since they are the ones that see the machines run every day. They know what normal machine conditions are and thud better equipped for seeing out of normal conditions with equipment they operate. TPM is not just about the operators that run the machines. It is also about motivating everyone at all levels and all departments to focus on plant maintenance. It includes such elements as a developed and mature maintenance system, basic companywide housekeeping, and employees that are skilled at problem solving as well as continually working to achieve zero breakdowns of equipment and machines. All this the while striving to set the plant up for zero product defects and accidents due to unscheduled breakdowns (Dennis, 2007).

At the stability level is waste elimination through 5S, which in lean provides transparency to the production floor using heijunka (Ciocioi-Troaca, Dumitru, Gheorghe, Nisipasu, Pascu, 2016). Heijunka is used to smooth production or keeping production steady without the spikes of the ups and downs (in production numbers) associated with mass production through producing only what needed when needed so it is ready as close to when needed. Using 5S provides transparency by removing waste and clutter, which provides greater visibility to waste and what is going on at the production floor level (Guan, Y., & Liao 2014).

Kanbans facilitate heijunka. Kanbans are communication devices used to control workflow of product materials from one-step in the process to the next. Kanbans are about only producing the quantity needed when called for and moving forward with no more or no less. The idea being that one product at a time flows through production only when the Kanban of the next process tells the previous process step to move the product forward or replenish it and at what quantity (Fabrizio & Kremer. 2005; Ohno, 1988).

Standardization is called the workhorse or engine of lean management. Standards are what allow people to communicate; “every language is a set of shared standards” (Moulding, 2010, p.102). Standards help to keep workers focused on the factory processes and each person knowing exactly what to do, when to do it, and how to do it. Standards maintain order and prevent the chaos that results from the possibility of everyone performing the same tasks, but doing things differently. Kitano (1997) said the process of standardization also identifies safety and ergonomic issues so they can have standards set that resolve such issues. In standardization, standards are set for work that is facilitated by Kanbans and A3 thinking. A3 thinking is a standardized report. The report shows one problem on a page or war board to get a quick visual on what the problem is and what is being done to the solve production or machine problem (Mann, 2005; Moulding, 2010).

Just-in-time (JIT) is the first pillar holding up the house of lean. JIT means providing the quality products customers order by producing only those units ordered, exactly when needed. Using JIT helps to increase company profits through the elimination of unnecessary inventories of parts in production and as finished goods (Dennis, 2007; Kremer & Tapping, 2012). The three components of JIT are pull, takt, and flow. Pull is production dictated by the customer. Start a part only when customer orders it. Parts only move to the next step in the production when the Kanban of the machine used for the next step indicates it is ready. Order production only finishes and becomes ready for shipping just in time of shipping to ready customer on specified delivery date (Kremer & Fabrizion, 2010). Takt is the amount of time it takes to produce one finished product as ordered by the customer. Takt allows for scheduling of production, so parts are ready on customer specified delivery date. Flow is moving products in the most efficient

method possible, which is one piece at a time as dictated by the pull-through method of JIT.

The other pillar, holding up the house of lean, is jidoka. Jidoka is quality built production, automation with a human touch, the quality principle, or respect for humans. There is no word that translates the exact meaning of jidoka from the Japanese word to English. Jidoka refers to the use of machines and people together to make sure no defective parts are allowed to travel down the production line. This pillar holds up the quality of the product by working to achieve zero defects within a JIT system (Kremer et al., 2010). White (2000) studied lean at Boeing and found Boeing "defines jidoka as creating highly efficient and reliable system…where quality plays into lean manufacturing" (White, 2000, p.20; Deros, Rahman, Rose, & Nordin, 2011).

In a quality system, problems affecting a product are addressed as soon as they occur. In a fully automated jidoka system, parts processing as well as 100% inspection and quality control monitoring are automated. When the automated system discovers a problem with a product or part, it stops the whole production line immediately until humans discover and resolve the problem. In addition anyone, anywhere, and at any level in the plant is empowered to stop the flow of production when they think there is a quality problem. Jidoka is also used, in manufacturing as a mix of automated processes and manual process referred to as semi-automated production or even all manual processes. The key to jidoka is still 100% part inspection, be it automated or manual (Ohno, 1998; Wilson, 2010).

Jidoka is building quality into production through separating human work from machine work, developing defect-prevention devices, and applying it to all operations (Kremer & Fabrizio, 2010). As stated before, Jidoka can be fully automated or semi-

automated and is not the same as automation. Jidoka is done slowly and systematically to make sure machines do only value added work. Value added work is work that adds to the processing or inspection of a product as ordered by customer. Jidoka makes it easy to change any production processes. Plain automation or automation without Jidoka is much harder and more costly to change (Kremer & Fabrizio, 2010).

Minimizing Waste (Muda)

All principles of lean are tied to the first and most significant principle, minimizing waste. In Japan, waste is known as muda. Through lean manufacturing, work is done to identify and eliminate waste. Waste in a company is any activity for which the customer is not willing to pay (Dennis, 2007). A muda process is any process that if removed from the company, would have no adverse effect on the finished product. (Iqbal & Najafi, 2011). In lean manufacturing seven types of waste are identified that must be addressed and removed. These seven wastes were stated earlier in detail, but are stated again here. They are defects, overproduction, waiting, not properly utilizing resources, transportation, and motion. (Kester, 2013; Southworth, 2010).

Continuous Improvement (Kaizen)

As indicated previously, in the comparison of traditional manufacturing versus lean manufacturing, traditional manufacturing is about keeping machines running as much as possible and if the machine or process works most of the time then do not touch it. In a lean environment that is not the way companies operate. Instead, lean environments operate on a cycle of continuous improvement of machines and processes known as kaizen and in U.S. manufacturing the term kaizen event is used often. Kaizen events are were a person or persons work to improve the company by improving a company process, procedure, or machine (Alhuraish, 2015). The improvement could

include improving production efficiency, improving workplace safety, or improving product reliability, to state a few of the reasons for a kaizen event (Dodd, Rizzo, & Workman, 2008).

According to Rubrich and Watson (2004), there are eight defined problems areas for kaizen events. These eight problem areas include cost reduction, quality improvement, productivity improvement, setup time reduction, cycle time reduction, manufacturing lead time, work-in-process inventory reduction, improvement of product design to increase performance or customer appeal (Groover, 2000; Rubrish & Watson, 2004). A kaizen event starts with the identification of waste in one of the seven problem areas. Identification of waste is followed with identification of the root cause and development of a plan to reduce or correct the situation. Next is to implement the improvement plan, followed by standardization of the work process to maintain the implemented correction plan. The cycle then starts again with identification of either more waste in the same process just improved or another waste identification and improvement opportunity as shown in figure 2 (Fabrizio & Kremer, 2010; Goforth, 2008; Rubrich & Waston, 2004).

Benefits of Lean Manufacturing

Research on implementing lean manufacturing has shown that when properly and fully implemented in U.S. manufacturing, the results provide many benefits. These benefits include, but are not limited to increased company efficiency, culture changes within an organization, and reduction of manufacturing costs (Engum, 2009). Research showing the benefits of implementing lean manufacturing in U.S. companies comes from dissertations and articles by Engum (2009), Schonberg (2011), Fauss (2012), Kim (2002), and Tayne (2010).

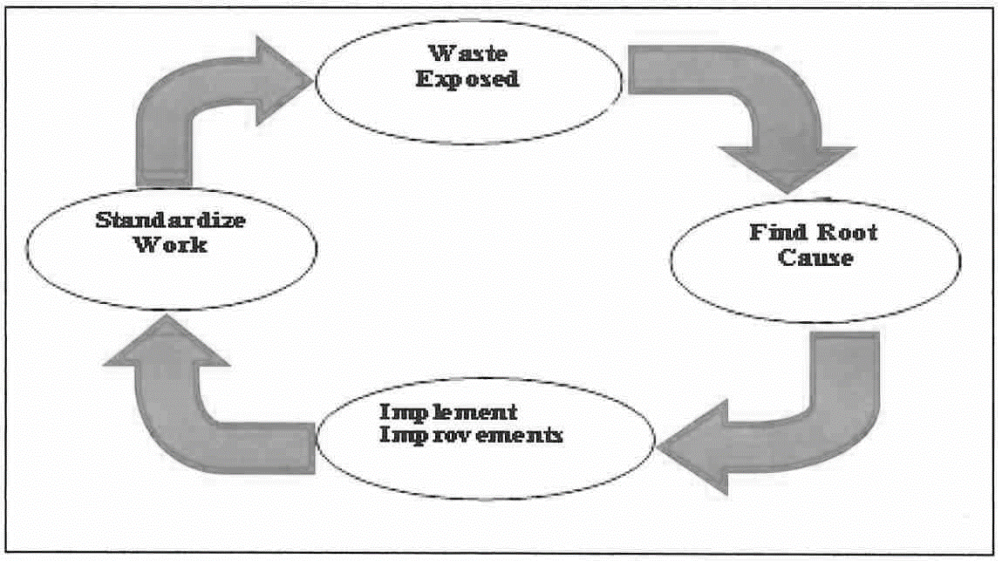

Figure 2. Continuous cycle of improvement or kaizen. From Continuous cycle of improvement or kaizen. Reprinted from *Implementing world class manufacturing*, p. 391, by L. Rubrich and M. Watson, 2004, Fort Wayne, IN: WCM Associates. Copyright 2004 by Rubrich and Watson. Reprinted with permission.

Engum (2009) studied lean implementations in newspaper printing. He identified the benefits received by newspaper printing companies, around the world that have implemented lean. Of the 64 newspaper printing companies investigated, 62.5% were printers in the U.S. In this work, Engum administered a survey to the printing companies to find out how many have implemented lean manufacturing and to rank the benefits they have received from their lean efforts. Engum found that these manufacturers ranked organizational culture changes, significant cost reductions, and efficiency increases as the highest benefits they received from implementing lean in their organizations.

Fauss (2012) studied the optimization of the manufacturing process for dyesensitized solar cells using lean manufacturing and six sigma. Originally, before optimization, the manufacturing process for dyesensitized solar cell manufacturing took four hours and fifteen minutes. After implementation of lean manufacturing, the

dyesensitized solar cell manufacturing process dropped to an hour and fifty-six minutes, a 54% drop in time.

Kim (2002) conducted an exploratory study to assess the implementation of lean in the construction industry and Jamain, Ismail, Ismail, and Rahman (2012) small to medium sizes businesses. In this research, case studies were used to assess, the benefits seen by those in the construction industry that implemented lean manufacturing in their operations. Of the companies examined in both studies, the project managers and business executives alike reported benefits received, from implementing lean that were the same in each study. Benefits included better coordination, open communication, better workflow management, problem identification prior to starting work on a project component, better run meetings, and better knowledge gathering from the project participants.

An example of savings realized at Boeing, from the implementation of lean, was reported in the journal Industrial Engineering (2011). This article contains some of the savings gained by Boeing since implementing lean in 2002 in the model 737-jet assembly line. Through implementation of lean, production of the 737 moved from 30 days to 11 days. Space needed for the assembly process also dropped 41%. This drop in space reduced overhead, freed-up land and buildings allowing for selling the space. All gains were achieved from 2002 to 2011 (Schonberg, 2011).

Another example of savings realized from the implementation of lean comes from Rajenthirakumar and Shankar (2011) in a case study of an unnamed Indian manufacturer. In this case study the implementation of lean in a manufactures' wet grinding department was observed. Prior to implementing lean Rajenthirakumar and Shankar observed: high lead times, inventory accumulation that was taking up 40% of shop floor space,

unnecessary movement of materials, employee fatigue that was adding accounting for as much as 10% of production lead times, man power that was underutilized, and a nearly nonexistent inventory management system. Many of the eight types of waste were found in manufacturing. From the implementation of lean, this Indianan manufacture received lead time reduction of 26%, cycle times reduced by 8%, assembly line production volume increase of 23% and a general observation of a large reduction in used floor space.

Tayne (2010) studied the application of lean philosophies for the use of continuous improvement among medical device manufacturers. Several examples of benefits gained by medical device manufacturers, who have implemented lean, are uncovered in this study. For example through the implementation of lean manufacturing Medtronic Xomed "shipped order lead time [fell] from 367 to 136.5 minutes and decreased the processing time from 28.3 to 16.5 minutes…[while] freeing up six employees to other areas of the organization" (Tayne 2010, p. 67). Overall Medtronic Xomed achieved improvements in several areas because of implementing lean. Total production lead-time decreased from 253 days to 129 days. Production cycle time decreased 97%. Standard order-to-ship lead-time decreased 54 days. Cost of shipped product decreased 38%. Productivity, annual sales per employee, increased 40%. Inventory turns improved work-in-process by more than 20 turns. Scrap reduced 85% and rework 57%. Floor space needed for manufacturing products was reduced 57%. On-time delivery improved from 85% to 96%. Cost of labor decreased 47% per unit. Finally, cost of the overall distribution dropped 42%. Tayne also investigated the lean gains/savings at Baxter Healthcare North Cove. Found was that total production lead time improved 74%, productivity improved 5% in packing, inventory turns increased from 25.45 to 41.9, scrap was reduced 50% per month for solution containers on the fill line, 22,000 sq. ft. of floor

space was cleared-up. Work-in-process reduced 30%, finished goods inventory was reduced by 9%, the number of steps in the production of products reduced 25%, and $1 million in cost savings was achieved. All of this was all realized over the first year after implementing lean manufacturing production.

Implementing Lean Manufacturing Problems

While lean manufacturing has many benefits, there can also be some problems if not properly implemented. Awareness of problems may help companies, looking to achieve lean manufacturing or struggling to implement lean manufacturing, deal with those problems. Dostie, in an interview conducted by Strozniak (2001), stated that one problem was that too many managers implement lean with the wrong approach. For lean to work it must be rolled out to the entire company, meaning everyone at all levels must be informed and involved. Often one of the most significant steps is skipped by not training every employee in the company on lean manufacturing. Thus, when managers do not get results as fast as they want they are ready to drop the entire initiative. Lean manufacturing is a process that is continual, and never finishes. All steps must be implemented and followed with the order including a rollout and training to the whole company and continually working on it.

Similarly, Dennis (2007) warned against the partial implementation of lean or lean without a plan to implement completely and continually work on it. Dennis said this might lead to poorly implemented parts of lean manufacturing. Included in this are such things as quick kaizens that do not get at the heart of lean. 5S implementations not maintained is also a problem here. The result of poor implementation is a process that does not return any of the benefits of lean.

In Croatia Celent, Gjeldum and Veza (2011) studied lean implementation problems in their countries beverage manufactures. In trying to implement lean they found that beverage manufactures experienced many problems when trying to implement lean. Some of the problems were due to the lack of clearly defined manufacturing process and what they called "interrupted directory chains" (p. 26). Having been developed initially for Japanese manufacturing, Easter European production companies often struggle to implement lean manufacturing because of the social and organization culture differences. Additionally, poor training in lean principles was leading to a misunderstanding of the heart of what lean is about and the continuous improvement cycles needed to maintain benefits from its implementation.

Barriers in the Implementation of Lean

A firm grasp on the basic methodology and concepts of lean is significant to any lean endeavor. However, because lean is a process of change, the relationship between the processes of lean and employees must be carefully managed. As a leader implementing lean, it is important to know and plan ahead for possible barriers and what aids there are to assist in the acceptance of lean by employees.

In the early years of lean in the U.S., Liker (1998) reported his observed rate of companies that experience any measure of success in implementing lean was about three out of seven. More recently Rubrich's (2004) study of firms claiming to be lean found only about 5% of companies claiming to be lean were truly lean. According to Liker (1998), this is compounded by the fact there are no true lean methodology experts to aid with lean implementations. While the components that comprise the house of lean are the same, the processes will be different for each company based on each one's unique business processes. There can only be people with more experience than others, but not

experts on every lean implementation to go from company-to-company and quickly setup lean.

Often when people think of lean manufacturing or implementing lean manufacturing processes, they think of doing more with less. In this thought is the misunderstanding that doing more with fewer means fewer people while at the same time increasing productivity, but that is not entirely true. Lean manufacturing is about doing more with less, but that less does not mean people will automatically lose their job because of implementing lean manufacturing. This perception leads to fear of job loss in employees and is counterproductive to lean manufacturing's implantation. According to Jones and Womack (2003), this thinking has led many companies to fail in their lean efforts. Employees have valid fears about how their jobs may change because of lean. Implementing lean manufacturing means redesign of many different processes at all levels of the company to lean things out. Leaning a company requires strong change management skills of leaders to help employees deal with these changes and possibly unfamiliar process (Jones & Womack, 2003).

Leonard (2007), in an unpublished master's thesis, identified factors that impede the implementation of lean through surveying 14 people who implemented lean. Those factors are in table 3.

Table 3

Impeding factors to lean manufacturing implementation.

Impeding Factors	Responses out of 14 Surveyed
Lack of management support	5
Lack of understanding	5
Resistance to change	4
Lack of employee buy-in	3
Lack of reason to change	3
Poor communication	3

Organization culture	3
Lack of training	3
Ineffective leadership	2
Traditional thinking	2
Bottom line thinking	1
Poorly planned implementation	1
Poor reasoning in management deadlines	1
Lack of effort	1

Note. Adapted from *Impeding and facilitating factors in the implementation of lean enterprise methodology*, 2007, p.39, by B. Leonard, Unpublished masters thesis, Purdue Unversity, IN. Copyright 2007 by Leonard.

Leonard also asked of his survey respondents, what factors facilitated lean implementation at each of their companies or companies at which they were consultants. The results appear in table 4. The final item of interest Leonard identified was the areas that the implementers felt companies needed to work on for lean to be successfully and fully implemented. Table 5 contains the responses.

Table 4

Facilitating factors to lean manufacturing implementation.

Facilitating Factors	**Responses out of 14 Surveyed**
Support of knowledgeable and effect leaders	7
Driven by crisis	4
Dedicated change agent	4
Employee ownership and empowerment	4
Continued Communication	2
Understanding theory and application	1
5S	1
Teamwork	1
PDCA	1
Focus on quality	1
Visual controls and management	1
Terminating resistant personnel	1
Training in change management	1
Supplier involvement	1
Customer involvement	1

Note. Adapted from *Impeding and facilitating factors in the implementation of lean enterprise methodology* p.40, by B. Leonard, Unpublished masters thesis, Purdue Unversity, IN. Copyright 2007 by Leonard. Reprinted with permision.

Table 5

Areas in need of improvement for full lean implementation.

Response Categories	Responses out of 14 Surveyed
Involve and empower employees	3
incremental implementation	1
Focus on existing problems	1
Banish non-supportive managers	1
Cross-departmental involvement	1
Use of PDCA model	1
Top-down approach	1
Establish upper management buy-in	1
Establish employee buy-in	1
Less theory more application	1

Note. From *Impeeding and facilitating factors in the implementation of lean enterprise methodology* p.40, by B. Leonard, 2007 (Unpublished masters thesis). Purdue Unversity, IN. Copyright 2007 by Leonard. Reprinted with permision.

In another study from the Netherlands, Ahaus, Antony, Solingen, and Timans (2012) also looked at factors that impeded lean implications. In a survey of case studies from small and medium sized manufactures in the Netherlands, the researchers found several factors that were holding back or troubling manufactures in their efforts to become truly lean. These factors included lack of resources to make the changes needed, internal resistance to the change, and lack of leadership clarity on what the true focus of business goals were to be.

Ghodrati and Zulkifli (date) also review existing works on lean implementation with a focus on 5S in industrial and business organizations and found that 5S implementation attempts were very often hampered by poor communication. There often was a lack of strong communication of goals and a lack of training to communicate what was to be accomplished with 5S between employees on the shop floor and the managerial level. This often resulted in poor budget performance, wasting of resource, and a reduction of employee moral when trying to implement 5S. Top managements must clearly define company goals with 5S and lean as well as what 5S and being a lean manufacturer means if they are to be successful in their lean journey (Abid, Naveen, Sanjay, & Sunil, 2013). The need for clearly defined and properly communicated goals is also pointed to as a strong issue 5S and lean implementation in the book Sustaining lean: Case studies in transforming culture (2008).

Another group of researchers from in India studied the results for a medium sized biscuit (cookies and crackers) manufacturer. This work was done in India by Deshmukh, Garg, & Upadhye (2010). In this case study, the researchers found that 5S and lean were

tools the company had used to “improve equipment availability, reduce waste of materials and improve quality”(p. 2.) This case study is significant in that it was the first found to talk about 5S and improved equipment availability. However, this case study does not say how the improved equipment availability was achieved and thus is not as pointed on changeover/setup times monitoring through 5S implementation.

5S

As already addressed, 5S is integral to lean manufacturing as a part of the ability to create and maintain clean, well organized, and clutter free workplaces. 5S eliminates the eight signs of waste as part of lean manufacturing implementation or as a standalone implementation (Lewis, 2011; Arroyo, 2015). Again, these eight signs of waste include defects, overproduction, waiting, not properly utilizing resources, transportation, motion and excessive processing

5S Research

A review of existing research on 5S, as of October 1, 2013, through Walden University and Google Scholar revealed fewer than two dozen documents on 5S. These works include a large majority in a language other than English, and include works by Bayo-Moriones, et al., (2008); Benjamin (2012); Ghodrait and Zulkifli (2013); Deror, Jun and Mohd, 2012; Rojasra and Qureshi (2013); Hutchins (2006); Lynch (2005); and Srinivasan (2012). The majority of existing writings on 5S are in languages other than English. However since 2013, the database of works, in English, on 5S has been slowly growing.

Bayno-Morines’ et al., (2008) study is titled "5S Use in manufacturing plants: contextual factors and impact on operating performance." Conducted in Spain, the purpose of this research was to measure the changes in quality, lead-time, productivity,

new product design, and employee satisfaction from implementation of 5S. Bayno-Morines et al., hypothesized that the implementation of 5S would relate "to better outcomes [in these factors] using different measures of manufacturing performance" (p. 219). These researchers also looked at several factors that defined the type of company that uses 5S in Spain. These factors include types of products manufactured, size of plant, nationality of plant, plants quality objective, workers involvement in continuous improvement, union or non-union, use of advanced manufacturing technologies (ATM's), and manufacturer that follows the use of the quality standards of the International Standards Organization (ISO) or the European Foundation of Quality Management (EFQM).

In this research, a questionnaire was distributed to 203 manufacturing plants in the northern region of Spain and interviews with a minimum of 20 employees at each plant. Bayno-Morines et al. were able to get 47% of the manufacturers to participate in the research. 5S questions were assessed on a scale of 0-10, with zero meaning not at all and ten fully implemented. From the investigation of the type of plant that implements 5S research the following result discovered. As the size of the plant increases the more likely, it is that the plant uses 5S. The researcher also found that Spanish companies were less likely to have 5S implemented than the multinational companies located in the north of Spain (table 6).

Table 6
Ranking of 5S by plant size and nationality.

Plant size			
<50 workers	51-150 workers	>151 workers	p-value
1.829	1.85	3.840	0.018
Multinational			
No	Yes		

1.810	3.333	0.034

Note. From "5S use in manufacturing plants: contextual factors and impact on operating performance" by Bayno-Morines et at., 2008, *International Journal of Quality and Reliability Management, 27*(2), p.223. Copyright 2008 by Bayno-Morines et al. Reprinted with permision.

Table 7 contains the results from the investigation of the relationship between 5S implementation, the type of product that the company manufactures and their company's most strategic important value. The result was statically significant that the type of product manufactured played an important role in whether a company used 5S or not. Manufacturers of intermediate (products that go on to other companies as part of a larger finished product) were mostly likely to have implemented 5S. However, Bayo-Moriones, et al., found that it did not matter what the strategic goal of the company was as no statistical significance was found between company goals and 5S implementation.

Table 7

5S use, Type of Product, and Strategic Priority

Type of products manufactured	Final	Intermediate	Capital	p-value
Importance of quality	1.7159	2.9718	1.4318	0.023
Importance of cost	1.9044	2.4776		0.259
Importance of flexibility	2.2442	1.8194		0.395
Importance of innovation	2.096	2.0769		0.979

Note. From "5S use in manufacturing plants: contextual factors and impact on operating performance", 2008, *International Journal of Quality and Reliability Management, 27*(2), p.224. Copyright 2008 by Bayno-Morines et al. Reprinted with permision.

Union vs. non-union manufacturers and employee involvement in improvement groups were also included as factors that might define manufacturers that implement 5S. With the involvement of employees in company improvement projects, there was a statistically significant and positive correlation relationship with the use of 5S. It takes employees at all levels to participate in improvement initiatives for 5S implementation. For the defining factor of union versus non-union, a positive relationship existed between the union influence and 5S use. In the north of Spain the more influence, the union had, the more likely the company was to have 5S implemented.

Table 8

5S use, Total Employee Involvement Groups, and Union Qnfluence.

Involvement groups	Yes	No				p-value
	2.86	1.47				0.00
Union influence	Very low	Low	Medium	High	Very high	
	1.0454	1.7857	2.2285	2.6153	3.6153	0.211

Note. From "5S use in manufacturing plants: contextual factors and impact on operating performance", 2008, *International Journal of Quality and Reliability Management, 27*(2), p.224. Copyright 2008 by Bayno-Morines et al. Reprinted with permision.

The final factor included was to determine if companies that are using one or both of the quality standards ISO 9001 and EFQM relate to use of 5S. ISO 9001 is one of a host of different quality standards that outline how the company is to maintain its quality program. EFQM is a quality standard promoted to European manufactures by the European Union. From ANOVA, companies with a quality program in place are also very likely to have 5S, as shown in table 9.

Table 9

5S use and Quality Programs.

Quality program	Average	p-value
ISO 9001		0.002
No	0.980	
Yes	2.580	
EFQM		
No	1.650	0.000
Yes	4.100	
Note: p<0.01		

Note. From "5S use in manufacturing plants: contextual factors and impact on operating performance", 2008, *International Journal of Quality and Reliability Management, 27*(2), p.225. Copyright 2008 by Bayno-Morines. Reprinted with permision.

While there was evidence that some manufactures in the north of Spain were using 5S, overall there was very little observed evidence that 5S has been widely adopted. Those that did have 5S implemented perceived several benefits to manufacturing operations (Bayo-Morinoes, et al. p. 225). After implementing 5S, perceived as significantly improved was productivity, performance, and quality of products. This shows that a tidy and well-organized manufacturing plant improves efficiency of machines as well as people. A clean and well-organized plant also makes defects easier to see and stop the line quicker, which may reduce the number of defects in addition to improving first-time quality of products. Along with these metrics other manufacturing metrics were also surveyed for correlation with 5S (table 10). Of these metrics, none was found to correlate with the use of 5S.

Table 10

5S use and Manufacturing Performance

	Spearman correlation	p-value
Productivity	0.163*	0.021
Quality (percentage defective)	0.155*	0.030
Quality (customer complaints cost)	0.213**	0.002
Deliveries fulfillment	0.076	0.284
Employee satisfaction	0.088	0.211
Lead time process	0.076	0.283

New product design and development time	0.101	0.199

Notes: *p<0.05; **p,0.01

Note. From "5S use in manufacturing plants: contextual factors and impact on operating performance", 2008, *International Journal of Quality and Reliability Management, 27*(2), p.226. Copyright 2008 by Bayno-Morines et al. Reprinted with permision.

Another study from Spain is one by Caro et al., 2016. In this Caro et al., studied the improvements achieved in a Spanish garment company though implementation of 5S. Prior to 5S the researchers found that this particular garment company was seeing an annual average of about 14% of its lost production downtime due to what they call visual pollution on the production floor. This downtime was quantified at an average of $30,582,022 in lost profits each year. Through the implementation of 5S, this garment manufacturer was able to able to remove waste in the process that equated to 12% more uptime for production and in the achieved cost of operational savings of $25,916,485 which is almost as much as they were losing in profits due to high production downtimes before 5S. This gain is in addition to the undisclosed increased profits from the 12% increase in time available for filling customer orders.

Deror, Jun, and Rahman (2012), benchmarked results seen from implementing 5S. Feeling the pressure to keep and or even improve market share, this company felt they were forced to look to other methods outside of manufacturing part production process improvement to do so. As this Indian company worked to implement the techniques that they found were proven to increase company products competitiveness in other countries such as Japan, 5S became the tool chosen to implement. The results of this Indian companies 5S implementation efforts can be seen in table 11, and shows large gains in defect reduction to the point of elimination in some areas.

Table 11

Reject Data Results from Implementing 5S in an Indian Manufacturing Company.

Reject Reason	Before Reject QTY	Parts Per Million	After Reject QTY	Parts Per Million
Label wrong orientation	31	3100	2	20
Continued				
Label wrong portion	3	200	0	0
Missing cardboard	23	2300	7	70
Missing screw	6	600	0	0
Continued				
Wrong label	3	300	0	0
Contamination	21	2100	4	40

Note. Adapted from "Benchmarking technique in lean manufactring (5S) practice", by Deror et al. 2016 Journal of Technology, 59(2) p. 113. Copyright 2016 Journal of Technology. Reprinted with permision.

Two Malaysian researchers, Ghodrati and Zulkifli (2013), studied the impact of 5S on two government manufacturers and three private manufacturing companies' performance after implementing 5S over a ten-week period. Through a questionnaire, Ghodrati and Zulkifli attempted to determine if there was any change in key performance indicators before and after 5S implementation. The researchers did not mention how and when a company was considered to have 5S fully implemented which would trigger the administering of the questionnaire to gather results data. Key performance indicators (KPI's) assessed using a questionnaire with 30 questions where responses were ranked on a Likert-type five-item scale. This type of questionnaire is very subjective to the opinion of the person being surveyed. Research data collected with Likert-type scale surveys, because of the subjectivity, may not reflect the actual physical results

Additionally, Giilespie and Hodge (2003) stated that five-point Likert-type scales might introduce a high level of error. The midpoint value is often interpreted as N/A when it is not coded as N/A but rather some level of greater than the last choice and less than the next choice. On a Likert scale when there is a midpoint, and it is N/A it is appropriate to remove the response in calculating score total. If the midpoint is not N/A and it is interpreted as N/A, it is hard to know what the respondent thought when they answered the question. The Likert Scale response selections in Ghodrati and Zulkifli's (2003) published results were not given. This provides the possible opportunity for problems with respondents possibly meaning N/A when they select the midpoint response. Despite the potential problems with the Likert-type five-item scale, employees' survey results, on KPIs, were used to indicate the organization's performance on the following items.

- Setting up the new goals, decisions making and direction the organization
- Safety and environmental issues
- Communication and information management
- Customer satisfaction
- Quality of product/service
- Efficiency (avoid duplicating, reworking, rejection and failure activities)
- Decreasing costs, life cycle time and loss of resources
- Motivation of workforce and employees' job satisfaction (Ghodrati & Zulkifli, 2013, p. 45)

Results gathered through the before and after 5S Likert surveys were as below in table 12.

Table 12

Results of Employee's Overall Impression of Company Performance Improvements on KIP's after Implementation of 5S.

Company number and type of manufacturer	Company overall organizational performance improvement
1 Private Manufacturer	49%
2 Government Manufacturer	53%
3 Private Manufacturer	50%
Continued	
4 Government manufacturer	70%
5 Private Manufacturer	54%

Note. Adapted from "The impact of 5S implementation on industrial organizations' performance" A. Ghodrati & N. Zulkifli, 2013, *International Journal of Business and Management Invention*, 2(3) p.47. Copyright 2013, by Ghorati & Zulkifi.

In addition to the potential problems with the use of a five-point Likert scale, there is another potential problem with Ghodrati and Zulkifli's research. It is possible that the period of ten weeks between the study start before 5S implementation, to the end of the study may have been too short. Participating companies may not have seen true results from 5S and over a longer period may have changed due to more improvements in 5S or perhaps not fully maintaining 5S properly. With results this great, they are hard to believe without any information on what the Likert scale choices looked like or real hard data like quality or productivity improvement numbers.

In a 2013 study, Qureshi and Roars study performance improvements achieved by a small plastics manufacturer through implementation of 5S. From implementing and maintaining 5S over a 10-week period, the researchers found that this Indian plastics manufacturer achieved what they call an efficiency improvement going from 67% to

88.8%, which was a 21.8% improvement in efficiency. The study did not specify how they defined efficiency.

Benjamin (2012) studied a hospital's efforts to implement 5S and identify the barriers that prevented full implement of 5S. The researcher surveyed only seven people in the hospital. Such small sample size may not be sufficient to answer the hypothesis of the research. Additionally, results from only one hospital does not make the results generalizable to other hospitals. Still it does provide some insight to this one implementation, which other hospitals could use as a gauge for what to expect. Table 13 contains the items that Benjamin offered to participants as possible barriers to the hospital's 5S implementation. In this table, the P number is the participant's randomly assigned number and one most significant while five is least significant in the results.

Table 13

Ranking of Importance of Barriers to 5S Implementation in one Hospital

Barriers	P1	P2	P3	P4	P5	P6	P7
Lack of communication	2	1	1	1	3	3	3
Top management issues	4	5	5	5	4	2	2
Lack of personal responsibility	3	4	2	3	1	5	5
Lack of training and knowledge	5	3	4	4	5	1	4
Lack of commitment	1	2	3	2	2	4	1

Note. From *Barriers in implementing the 5S system in the healthcare industry* p.24, by B. Benjamin 2012, Unpublished master thesis, Purdue University, IN. Copyright 2012 by Benjamin. Reprinted with permission.

In this study, Benjamin also asked participants to list other items they viewed as barriers to their 5S implementation. From this question, those surveyed gave six additional items they thought were barriers to the implementation of 5S (figure 3). The graph also indicates how many of the seven people thought each item was a barrier.

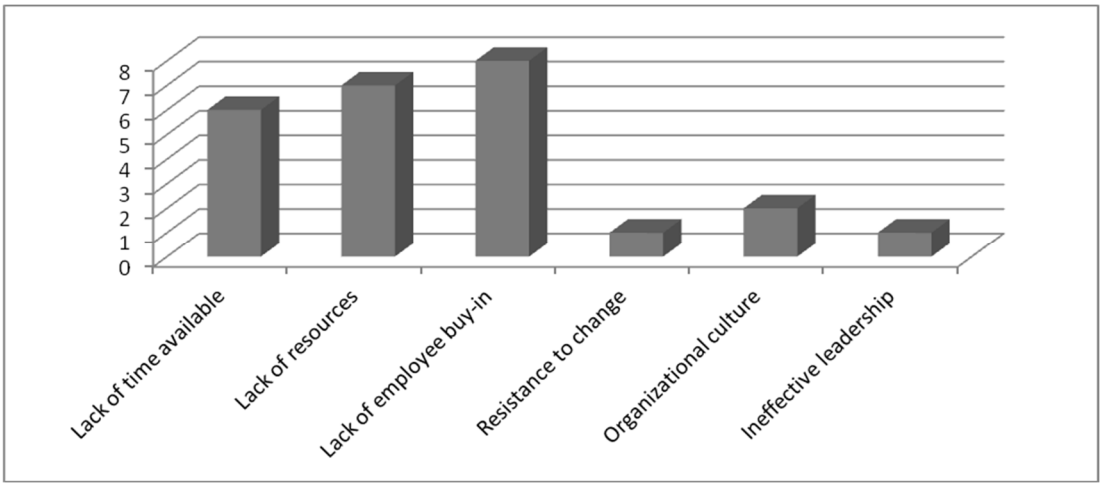

Figure 3. Additional barriers study members provided as area needing to overcome in order to implement 5S From *Barriers in implementing the 5S system in the healthcare industry* p.24, by B. Benjamin 2012, Unpublished master thesis, Purdue. University, IN. Copyright 2012 by Benjamin. Reprinted with permission.

In another work, Hutchins (2006) studied the implementation of 5S in manufacturing departments at Hasbro, where he worked. This Ph.D. dissertation included researching employee attitudes towards 5S and a series of productivity improvements at Hasbro from the implementation of 5S. Within Hasbro, there were six departments that comprised the experimental group, which implemented 5S. The control group consisted of two production departments that did not implement 5S. Data analysis was done to determine if a statistical relationship between 5S and productivity, product quality, safety, maintenance costs, product cost, and product holds for quality existed. The study starts with the collection of three months of data just prior to implementation the 5S initiative and the follow-up with three months of data after 5S full implementation.

In this research, Hutchins anticipated finding improvements in safety, quality, and productivity as well as a reduction in maintenance and product costs. The control group analysis for overall productivity showed significant change in the treatment group. However, this was not in the favor of Hasbro. Instead of productivity increasing in the favor of Hasbro, productivity decreased (Appendix A, figure 1A). This change, however was not found to be statistically significant and thus not a real problem. In the control group, productivity increased but was not statistically significant (Appendix A, figure 1B). From his research, Hutchins concluded that implementing 5S had no real effect on productivity.

Comparing the safety complaints (reported safety incidents, Appendix A, figure 1C), before 5S and after 5S showed an increase in safety complaints contrary to the researcher's expectations. The increase was not found to be statistically significant leading to the conclusion that 5S had no effect on safety complaints. In addition, contrary to Hutchins' expectations, there was a decrease in the reported number of safety incidents before and after 5S implementation in the control group. However, this was also found not to be a statistically significant.

For maintenance costs, there was no change in the cost from implementing 5S in either the treatment or control groups (as shown in Appendix A, figure 1D, and figure 1E). For product cost, there was a small, but not statistically significant increase in both groups (Appendix A, figures 1F and 1G). Both of these Hutchins expected decreases.

Hutchins also expected quality to improve because of 5S implementation. His measuring stick was the number of products put on hold for quality problems by the quality department before 5S and after 5S implementation. As hypothesized, before conducting the experiment, there was a decrease in the number of holds for quality after

5S implementation in the experimental group (Appendix A, figure 1H). Statistical analysis however, revealed this decrease is too small to be statistically significant. In the control group, the number of quality holds was found (Appendix A, figure 1I), but that was also not statistically significant.

In addition, Hutchins conducted a survey of managers and employees in both the control and experimental groups before and after the implementation of 5S on some of their opinions related to 5S. Following are the results of the survey.

- Department cleanliness: Differences between control and experimental groups from employee's view were not significantly different from managers.
- Workplace organization: Employees felt there was a significant change while managers did not.
- Management commitment: Employees felt there was not a significant change in managers' commitment [to them and their job] after implementing 5S.
- Jobs easier: Employees and managers alike felt there was no change in job difficulty.
- (However, greater input in decisions was making felt. Does not make sense) Employees and managers both felt there was no change. Why did you change the format?
- Cooperation between shifts: Neither managers nor employees reported that implementing 5S resulted in more cooperation between shifts.
- Control over workplace: Survey of employees only for this and no change found.
- Machine breakdowns: No significant change in the belief of managers or employees that 5S resulted in fewer machine breakdowns.

- Use of floor space: Employees felt there was a significant improvement in the use of floor space while managers felt there was not a better use of floor space after 5S.
- Job frustration: Posed to only employees, with no significant change in the frustration level with jobs reported. Increased job satisfaction: Neither group reported feeling more job satisfaction after 5S implementation (Hutchins, 2006).

In this case, with Hasbro, the effects of implementing 5S are not as far-reaching as the researcher expected. Is 5S overrated? It is hard to tell with just this one research work and only one company. Another researcher giving a glimpse into the benefits of 5S and manufacturing, which is also in line with the goal of this dissertation, is a research work by Lynch (2005). In this work, Lynch examined the relationship between 5S and the metrics of productivity, cycle time, and quality in manufacturing. This study is a descriptive study in which the author examined existing data from January to November 2003 in three different departments of a large Midwestern factory. Lynch defined the metrics as stated below.

- Productivity - earned standard hours for all of the operators in the department for each month divided by the total direct labor hours performed during that month.
- Quality - the total number of pieces accepted in each of the departments for each month divided by the pieces submitted during that month.
- Cycle Time - the number of days from conception to end, per piece during each month, was divided by the number of pieces sold during that month. (Lynch, 2005, p. 78)

Lynch's study is interesting because like Hutchins, he also used hard data numbers to show actual results achieved by the manufacturer from the implementation of 5S. However, as with Hutchins' work this was conducted at the place of employment and thus only one company. In this study, Lynch was interested in how productivity, quality, and cycle time trended with 5S scores in the three departments that implemented 5S. From the review of existing writings and research on lean and 5S Lynch, expected to see that as 5S scores increased, productivity and quality increased while at the same time a decreased cycle time. Lynch found the following in figures 14-16 for each of the three departments.

From these results, does 5S have an effect on these metrics? Lynch examined "how X (5S) moves with Y (productivity, quality and cycle time)" using Pearson's correlation and then a t-test to find the p-value (Lynch, p. 65). Null hypothesis for each of the metrics reviewed was that there was no correlation between each metric and 5S. While the alternate hypothesis was a correlation between each metric and 5S exists. Given in table 14 (below) the graphs it can be seen that statistical significance was found between some of the metrics and all of the departments.

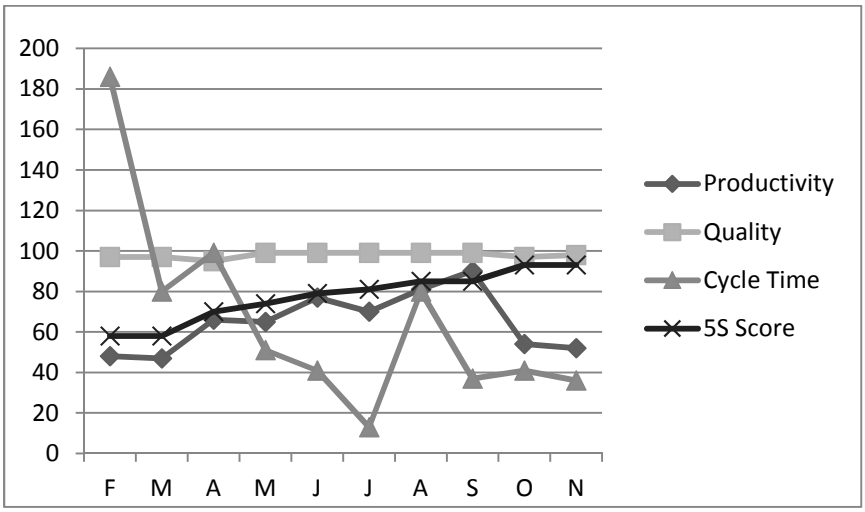

Figure 4. Results for Lynch's data review of department D55's productivity, quality, cycle time, and 5S score. From *The relationship of lean manufactuirng principles to quality, productivity, and cycle time*. p. 86, by L. Lynch 2005, Unpublished doctoral dissertation, Walden University, MN. Copyright 2005 by Lynch. Reprinted with permision.

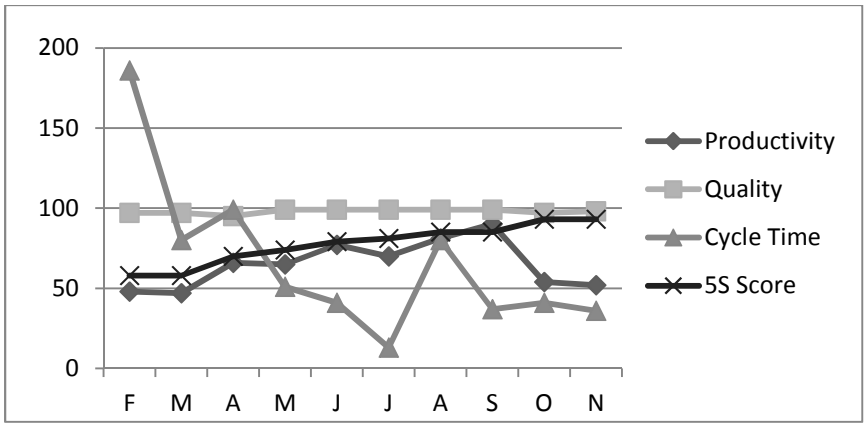

Figure 5. 5S intervention results D63. From *The relationship of lean manufactuirng principles to quality, productivity, and cycle time*. p. 87, by L. Lynch 2005, Unpublished doctoral dissertation, Walden University, MN. Copyright 2005 by Lynch. Reprinted with permision.

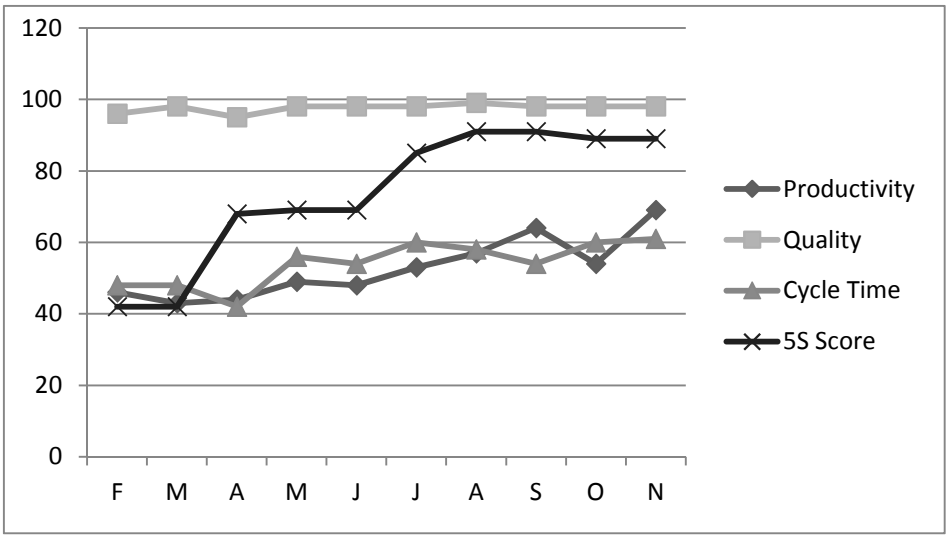

Figure 6. Results for Lynch's data review of department D71's productivity, quality, cycle time, and 5S score. . From *The relationship of lean manufactuirng principles to quality, productivity, and cycle time*. p. 88, by L. Lynch 2005, Unpublished doctoral dissertation, Walden University, MN. Copyright 2005 by Lynch. Reprinted with permision.

Table 14

Statistical Significance Between 5S and Reviewed Metrics.

	Productivity	Quality	Cycle Time
D55	Yes	No	No
D63	Yes	No	No
D71	No	No	Yes

Note. From *The relationship of lean manufactuirng principles to quality, productivity, and cycle time*. p. 103, by L. Lynch 2005, Unpublished doctoral dissertation, Walden University, MN. Copyright 2005 by Lynch. Reprinted with permision.

These results were not exactly what Lynch (2005) expected to see. Lynch expected to see a statistical significance between 5S and all metrics in each of the three departments and speculated that these results could have been due to a number of other influences that could have affected (cycle?) the study adversely. However, because this was just an investigation of existing data, Lynch could only speculate about the reason since he was not present in those departments at the time of 5S implementation. For

quality, the contrary results Lynch speculated may have been because quality was already near 100% in each department to start. Additionally, from his work Lynch noted that there was a strong lack of support for 5S from managers that could have also affected the results. Despite all of this, Lynch still concluded that implementing 5S might have some positive effect on cycle time and productivity. Additionally, even though it was not possible to tell if the quality was positively affected by 5S, the lack of change in quality meant that 5S did not have a negative effect.

Lynch's (2005) work could to some extent confirm Ohno's work that the implementation of 5S to remove waste in the company could increase profits. A productivity increase in two of the three departments was an opportunity for more product throughput throughout the company to could fill more orders and thus make more profit. However, because there was a decrease in one department's productivity, no matter what the reason, derailed any chance of increased total plant productivity. A look at more than one company where the researcher is present, actively collecting data, monitoring more closely the situation going on, as well as the management's support for 5S may show different results. Further research to confirm or refute Lynch's study would be useful.

The final research published on the topic of 5S in manufacturing is a study of the relationship between 5S and employee safety at a manufacturer in Baton Rouge Louisiana by Srinivasan (2010). One week before 5S implementation a Likert-type 5-point scale survey was administered to collect the current view of research participants on safety in the company. The midpoint question of this Likert scale selections was neither agree nor disagree, which should not have been mistakenly interrupted as N/A. One month after 5S implementation, the survey was administered to collect final opinions of

control and treatment groups. The results of the survey were used to ensure that 5S was the only contributing factor to any increase in safety of the treatment group. Statistical analysis revealed that 5S was, in fact, the only contributing factor to any increase in treatment group safety. From the company surveys, Srinivasan also found that the view of the safety climate was one of having significantly increased to safer, in both the experimental and control groups and found it to be a statistically significant change.

Productivity measures were also taken to make sure the 5S implementation was effective. For assessing 5S implementation effectiveness, Srinivasan analyzed the productivity metrics of available floor space, cycle time, and inventory before and after 5S implantation. For these elements, there was a significant improvement which he thought demonstrated that 5S was the effect. Srinivasan concluded that the 5S implementation had a significant effect on the climate of safety in this one company.

Both Hutchins and Lynch stated that there was a lack of support from managers that may (have negatively influenced their results. I focused on researching the effect 5S has on production productivity in U.S. manufacturing, which is a similar focus to what Hutchins and Lynch did. Specifically, I will study how 5S affects production machine changeover/setup times, which are not yet studied by anyone. Additionally, this research was conducted in companies that have full support from management for the 5S implementation.

Summary

This chapter contained a literature review that provided some more detailed insight to the topic of 5S and lean, the link between the two, and some of the existing research on each. I covered the topic of lean because of the link between the two and much detail is included because of the overall lack of 5S scholarly research, especially in

the U.S. In my search of the literature, I only found seven research studies on the topic of 5S. Seven of the four were in other countries. The remaining three, one was on safety and 5S, and the reaming two were on productivity results and 5S in manufacturing and thus similar to what this research is proposing to study. This lack of research on 5S implementation was one of the reasons for taking up this proposed research. The other was the overall lack of competitiveness of U.S. manufacturing with other manufactures globally.

Chapter 3 is a description of the research in more depth than in chapter one. In this chapter are: research design and rationale, information on the role of the researcher, methodology, and logic for participant selection. This section also covers the details of the data obtained as part of this research including instrument used to collect data, data collection, and analysis plan. The chapter wraps up with a section covering different issues of trustworthiness.

Chapter 3: Research Method

In the U.S., many manufacturers only see 5S as a reason to perform housecleaning tasks (Pate, 2013). However, there are other reasons for using 5S as already mentioned in previous chapters. The view of 5S as housecleaning may be a reason why many U.S. manufacturers do not implement 5S fully, properly, or at all. This may also be due in part to the fact that there is very little research on how 5S can benefit U.S. manufacturers and improve their competitiveness in the global economy, based on what I found in my literature search on the topic. The purpose of this study was to determine whether increased understanding of 5S on the part of U.S. manufacturers translates into a change in production machine changeover/setup times.

In this chapter, I provide an overview of my research design and rationale and study procedures. Other sections include the setting, population, sample, treatment, and data collection. Further, the chapter includes the data analysis, statistics, and a description of the software used to analyze the data. The remainder of the chapter includes reliability, validity and ethical concerns.

Research Design and Rationale

The design for this study was a quantitative pre-experimental design, which is called a one-group pretest-posttest. From my understand of experimental design I selected a pre-experimental design and because I could not find any companies to use as control group. A pretest gives some idea of changeover/setup times on manufacturing production machines prior to the treatment administration. This design also has the advantage of conducting research without a control group and at a minimal cost. In

addition, with a one-group pre-post design, statistical analysis can be used determine if the null hypothesis can or cannot be rejected.

While I felt that a pre-experiment design was appropriate for this research often pre-experimental designs may not be useful if the researcher cannot clearly explain the results because of uncontrollable extraneous variables (Bonate, 2000). It is also difficult to document change without one or more control groups for comparison (Bonate 2000).

I did not consider quantitative designs such as surveys and experimental designs, qualitative research such as grounded theory and phenomenology, and comparative research to be appropriate or feasible for this study. Comparative research is used to examine two or more groups for differences between the dependent variable(s) of the two groups (Ragin, 2014) which I didn't have. An experimental design is used to collect data in a laboratory or environment where there is the ability to control the variables of the experiment. Additionally, experimental design is performed with precision calibrated instruments (DePoy & Gitlin, 2011). This research was conducted in the field to get the true picture of what happens in real time manufacturing operations. Thus, a laboratory or environment with strict control of variables is not appropriate. In my research, the field consisted of three different manufacturing companies. However, because of lack of a control group, I could not do comparisons as would be done in a true experimental design.

A researcher using a grounded theory method aims to generate theories by studying social phenomena in an iterative process. Analysis of the first data gathering leads to other cycles of data collection with new examples that are similar to the last to refine emerging theories (Charmaz, 2014). Data collection in grounded theory is

primarily done through interviews. Grounded theory was not applicable to this study since I did not conduct interviews.

Phenomenological research is used by researchers to focus on the experiences of the research participants and how they interpret their experience. A variety of methods for gathering data exists for this type of research, but the primary data gathering is through interviews. Phenomenology is useful for gaining insight to experiences that are subjective such as reasons for people's actions or motivations. This research method was not appropriate for this research study because interviews were not done.

Methodology

Methodology for this research was probably the hardest part for me. I had no idea what I was going to study. How and who was a whole difficult thing for me. I struggled trying to come up with something because dissertation research I looked at, in trying to get my bearings, and found interesting were studies of existing data from companies the researchers worked at and at the time I started this journey I was very unemployed. However, the study population, sampling, and data analysis plan seemed to just fall together suddenly overnight.

Population

The population for this study consisted of manufacturers in the Portland and Salem cities of Oregon. An e-mail was sent to all members of the Portland, Oregon chapter of the Society of Manufacturing Engineers to recruit participants. Seven companies contacted the researcher with interest to be a part of the research. Based on a visit to the seven companies, three companies fit the need of this research, which is that they run continuous production. The other four were specialty product manufacturers that did not have continuous production machines, did not produce the same type of product

from part to part or has only one product. Thus, these four had varying changeover/setups or no changeovers at all.

The first participating company makes sunglasses. It has jig and fixture changeovers between different models being manufactured. The sample size (all production machines with changeover/setups) at this company is two laser-cutting machines. The second, a plastics injection molding company, has changeovers/setups each time it switches to different parts with seven plastics injection molding machines. The last company is one that makes wood moldings and has changeover/setups each time it fulfills new customer orders or makes for stock products. The sample size here is one wood molder machine.

Sampling and Sampling Procedures

The main value being analyzed in this study was production machines changeover/setup times in minutes and seconds. I measured changeover/setups on all production machines at each of the three participating companies. One method of measuring time is with a stopwatch, which is a standard instrument for measuring time. Data collected for production machines changeover/setups were obtained using a stopwatch application download on my tablet computer. Data were recorded in an Excel table and on my tablet computer.

The other data collected was 5S scores. 5S scores were evaluated and collected using a 5S audit from obtained from the company Enna, which offers training and consultation services in 5S and lean manufacturing (Enna website). Enna also sales tools to help companies implement and maintain 5S and lean manufacturing. I chose to use the 5S form from Enna, as it is similar to the proprietary 5S form used at the Japanese company where I worked and is a standard method for evaluating 5S from my experience

implementing and maintaining 5S in many different manufacturing companies. Enna first published this form in 2005. Enna could not tell me how many companies have used the form or what industries have used it. What they could say is that, since 2005, its 5S audit form has been a consistent seller. I believe that the audit form is valid because other it is similar to the one used in the two companies I have worked for to evaluate the state of each of the 5Ss in their companies.

The sample population for this study consisted of manufacturers in the Portland Metro and Salem cities of Oregon. I did not random select manufacturer participants. I picked companies that needed to have 5S implemented at there companies. In addition I selected companies that would be close enough to my home so I could easily travel between the participating companies, do my research each day and then back to my home in the course of one day.

An e-mail was sent to all members of the Portland, Oregon, chapter of the Society of Manufacturing Engineers to recruit participants. Seven companies contacted the researcher with interest to be a part of the research. Based on a visit to the seven companies, three companies fit the need of this research, which is that they run continuous production. The other four were specialty product manufacturers that did not have continuous production machines, did not produce the same type of product from part to part or has only one product. Thus, these four had varying changeover/setups or no changeovers at all. All data for this research was collected on the manufacturing floor. As researcher, I collected all the data at each participating company. I started by first conducting two audits at each company participating in the research. The first was a 5S audit evaluating the participating companies on the each of the elements of 5S. Following this, a measure of production machine changeover/setup times was obtained. Both will be

done to establish a baseline for each company's current 5S status and times for changeover/setup prior to treatment.

I returned on a random day, at least once every two weeks after treatment was applied to a company, during the 5S implementation process to conduct additional 5S audits. This process continued at each participating company until the company reached an overall 5S score of 4.5 or greater. 5S overall score of 4.5 or greater is used because that is the score classified as outstanding on the standardized 5S audit form from Enna. 4.5 is also the score I have seen Japanese companies use to consider 5S fully implemented and being properly maintained. Having reached an overall score of 4.5 or greater a company was considered to have fully implemented 5S, which triggered the collecting of final changeover/setup times on production machinery. Finally, machine changeover/setup times were collected until the same number of data points collected as in the in pre-treatment data collection are obtained.

The number of changeover/setups measured was not known at time of starting the study. It depended on the mix of the product being run on at the time data were collected at each company. Because of this unknown, it was also not known if a z-test or t-test would be used to determine if the change in machine changeover/setup times would be statistically significant or not. If I could get greater than 30 samples, I would be able to use a z-test instead of a t-test, which provides statically a greater chance of the results actually representing what they are meant to represent (Urdan, 2010).

I recorded changeover/setup times in on my tablet computer first and then converted that file into an Excel table. The design of which was unknown until the time of data collection. I needed to know machine changeover/setup information and the product mix running on each machine measured so that the data collected in pre-

treatment was duplicated in post treatment to be able to create the Excel tables. The Enna 5S audit form was also converted to an Excel spreadsheet so that scores could be collected and then graphed automatically. A copy of this form is in Appendix F.

Data Analysis Plan

I hypothesized that the introduction and maintenance of the manufacturing principle of 5S will change changeover/setup times on production machines and that change will be statistically significant. The null hypothesis (H0) was the use of 5S methodology does not change the changeover/setup times on manufacturing production machines in a way that is statistically significant (H0: $p = 0$). The alternative hypothesis (H1) then followed as the use of 5S methodology does change changeover/setup time on manufacturing production machines in a way that change is statically significant (H1: $p > 0$)

I measured changeover/setup times with a stopwatch. The machine changeover/setup times were taken once before the treatment and then again after 5S were fully implemented at all three companies. I then ran a z-test or t-test on these times to determine if there was a statistically significant change between the pre and post measurements. I used Excel and SPSS to calculate and present the results.

The number of changeover/setups measured was not known at the start as it depended on the mix of the product being run on the day of data collection. It turned out that changeover/sets had to be collected over a number of days to obtain enough data points for to try to collect enough data to adequately answer the hypotheses. However, it took three weeks at each of the companies to get at much data as I did. Thus, it turned out I only got greater than 30 samples at one company. This is important because the t-test gives less confidence than the z-test statistically that the results of the research are

making a reasonably accurate statement about the differences in the change before and after 5S being statically significant or not (Urdan, 2010).

Threats to Validity

Internal Validity

No other treatments other than the training in 5S and then the implementation of 5S (independent variable) were applied to the manufacturing environment or the production machines. The owners of each company had assured me this prior to conducting research and stuck to their word. Thus, no other research added confounding variables that might have altered the study.

At the start of this research, I could not assure that there would not be an internal validity threat from subject attrition. Attrition of employees at each company could have happened at any time. During the study, those whose working times are being measured could have quit working. Thus a company could be short a person or have a new person performing the production machine changeover/setups that I was measuring. This did not happen as I checked for employee attrition with each company before I started post 5S data collection.

There might also be a threat to validity from the possibly large confidence interval that will come with the use of the t-test because of the possibly small sample size, $n<30$. The smaller the sample size, the larger the confidence interval that is needed to account for the additional uncertainty in the results that comes with such small sample sizes (Urdan, 2010). I made every attempt to collect more than 30 samples to be able to use a statistical z-test instead of a t-test giving a narrower confidence interval; due to time constraints, I was only able to get 30 or more samples at one company. Confidence

interval is important because it gives more confidence that the results of the research are making a reasonably accurate statement.

External Validity

This research is not being generalizable to other companies. This is because the companies involved in this study are not representative of and have not been randomly selected from a large group of manufacturing companies. This is the only external validity threat that might be related to the study.

Ethical Procedures

Each company in the study had given permission to access the needed data via a verbal commitment in a phone conversation when companies were contacted to determine if they were a viable company for the study. Performance of this study did not have any intervention applied directly or indirectly to human subjects, so there are not any personal rights that needed protecting. However, there were requests from some of the participating companies to not have their data labeled. Therefore, the data were labeled as companies A, B, and C. I also assured each company that their production would not be affected in any way during the data collection process and it was not.

Summary

This chapter contains the methodology used in this research study. In summary, the research was a descriptive, one group, and pretest-posttest design with data collect through use of 5S scorecard, a stopwatch and the software package Excel. Statistical analysis of this data t-test or z-test to test for statically significance. I made every attempt to collect more than 30 samples to be able to use a statistical z-test instead of a t-test to give the narrower confidence interval. However, due to time constraints this was not possible. The importance of the confidence interval being narrower with the z-test is that

it would give more confidence that the results of the research are making a reasonably accurate statement. This chapter also contained material related to issues of trustworthiness and possible threats to validity.

Chapter 4: Results

The purpose of this study was to determine if increased understanding of 5S translated into a change in production machine changeover/setup times when 5S is used in U.S. manufacturing and if any change is statistically significant. This was done as field research using a pre-experimental design, as I could find not companies willing to be part of the control group. Another purpose of this pre-experimental design research was to indicate if a fuller field study, with a control, would be worth the time and money. This would be indicated if results show a statistically significant change in changeover/setup times from pre 5S to post 5S. The null and alternative hypotheses were

H1: The use of 5 S methodology does not change the changeover/setup times on manufacturing production machines in a way that is statistically significant.

H_0: The use of 5S methodology does change changeover/setup time on manufacturing production machines.

Research was conducted at three separate companies. Each company was treated as its own independent research at first. It was not my intention to combine all data because I did not understand that I could combine all the collected data from each different company into one statistical calculation. I thought that, since the change/ever setup times would be significantly different between different machines and processes, I would need to treat data collected from each machine as an independent research experiment. To clarify this matter, I spoke with both Dr. Zin, Walden University's statistician and a statistician with Elite Research, Weidan Zhou. I learned that I could do both independent calculations as well as combine all the data into one pre and post treatment set of data. What I needed to combined data analysis was take into account the variance in the dependent variable through the statistically analysis repeated measures

ANOVA. In addition, I collected all the 5S and changeover/setup time data for each company and machine as well as performed all the data analysis using Excel and SPSS.

This chapter contains the results of my data collection, the treatment data analysis, and the final study results for each t or z test of companies' machines individually or grouping of same machines and then all data combined into one set of pre and post 5S ANOVA analysis.

Data Collection

Data collected was first the initial 5S evaluation at each company followed by a pretreatment changeover/setup times on production machines. This was followed by more 5S evaluations until each company reached a 5S audit score of 4.5 or greater. Data collection was wrapped up by collecting the post treatment changeover/setup times on production machines. The makeup of each of these can be seen in the completed 5S audit forms for Companies A (Appendix F), B (Appendix G), and C (Appendix H, respectfully). The 5S form is what was expected to be used to collect this data. Appendices F, G, H each end with the data pre and post treatment collected data for each machine(s) at each of three companies that I studied.

The t-test or z-test, in Excel and SPSS, for analyzing data change between pre and post treatment for each machine individually or group of same manufacture and model machines with similar changeover times was as partly, what was expected to be done as per the proposal. My use of SPSS in addition to Excel, as originally planned, was due to a recommendation by one of the statisticians whom I consulted. SPSS displays results in a cleaner format than Excel as a I learned using both. SPSS Was also used because it can do the ANOVA test I needed for all combined data that I collected from each of the three companies. Combining all the data, from each of the three companies, produced a data set

size of 110 pre and post treatment machine changeover/setups. This is important because the larger the data size the more assurance it gives to the fact that the data collected is actually measuring the changeover/setup times it is means to measure.

I strove obtain a production machine changeover/setup sample size of 30 or greater on each different machine. This sample size is because, as I originally thought, I needed to do so data results had a greater chance of actually representing change in pre to post treatment changeover/setup. Due to the length of time that it took me to collect data, I was only able to collect a sample size of greater than 30 at one company. I spent 3 weeks at each company before treatment to collect the pretreatment production machine changeover/setup data.

As planned, I collected the data and used a stopwatch to record the results in a spreadsheet on my tablet computer. After 3 weeks of data collection, I realized that it would take many more weeks to get data sets sample sizes of 30 or greater for more than just one machine using each company's scheduled production run data. Due to time constraints, I opted to limit my sample size to what I was able to collect during this 3 week period.

After the initial, pretreatment machine changeover/setup times were collected, I conducted a 30 minute training session on 5S at each company. The purpose to teach each company about the manufacturing practice of 5S. Following this, I started collecting 5S information for each company in the study. The length of time that it took me to collect these data also varied for each company. The variation was because it took different amounts of time for each company to get 5S fully implemented. 5S data collection time frames for each of the companies was as follows: Company A took 23 weeks to reach full implementation of 5S; Company B, took 10 weeks; Company C, 12

weeks. Full implementation indicated an overall score of 4.5 or greater on a 5S audit. While I waited for each company in the study to fully implement 5S, I returned once every 2 weeks (after I had delivered training in 5S to each company) to fill out a 5S audit form. In doing so, I sought to find out whether 5S had been fully implemented or whether more time was needed for this to happen.

Upon each company completing 5S implementation, I began again measuring machine changeover/setup times to find out what they were post treatment and 5S implementation. Unlike the pretreatment, post treatment data colletion was not as simple as collecting the same number of data points as pretreatment and then move to the next step. I had to carefully match each machine changeover/set from the pre data collection to a corresponding time in the post data collection. This meant, for example, if I measured the time, it took Company A to change machine 7 from die 1 to die 2 in pretreatment data collection then in post data collection I made sure I measured the same Company A change of machine 7 from die 1 to die 2. Thus, in post treatment I was measuring exactly what I had measured at each company in pretreatment to create paired samples for pre and post data. Postproduction data collection took 6 weeks to complete based on the mix of production being run at each company.

Treatment

Treatment for this study went exactly as planned. All companies were given the same treatment. The treatment consisted of one approximately 30 minute training on 5S. This was done using a PowerPoint presentation (see Appendix E). I provided all employees at the three companies with a copy of the training PowerPoint slides.

Study Results

As already reported, I did two different analyses of the collected pre 5S and post 5S treatment data collected from each production machines changeover/setups, at each of the three companies. The first analysis of each machine or group of same machines with similar changeover/setup times to answer the hypotheses: null hypothesis (H0) the use of 5S methodology does not change the changeover/setup times on manufacturing production machines in a way that is statistically significant (H0: $p = 0$,). The alternative hypothesis (H1) then followed as the use of 5S methodology does change changeover/setup time on manufacturing production machines in a way that change is statically significant (H1: $p > 0$).

Company A t-Test

t-Test Machine 1

Let VAR0039 = Data set for pre 5S changeover/setup times in seconds

Let VAR00040 = Data set for post 5S changeover/setup times in second

Table 15

Company A, Machine one, Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00039	1566.583	12	177.578	51.262
	VAR00040	1254.166	12	77.526	22.379

Table 16

Company A, Machine One, Paired Samples Statistics

		N	Correlation	Sig.
Pair 1	VAR00039 & VAR00040	12	0.667	0.018

Table 17

Company A, Machine One, Paired Samples Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00039 VAR00040	312.4 166.7	138.45016	39.967 12	224.44 963	400.3 837	7.817	.000

Looking at the paired samples test results at the 95% confidence interval at significance of .000 is less than .05 so the change is significant. Therefore, the null was rejected and the alternative hypotheses accepted. There is statistically significant change in changeover/setup times on machine 1 at company A. Examining closer the paired sample mean changeover/setup time before 5S was 1566 seconds or 26 minutes. After implementing 5S the means changeover/setup time changed to 1254 seconds, or approximately 21 minutes. Thus, the change was a decrease in the amount of time for completing changeover/setups on machine one.

t-Test Machine 2

Let VAR0042 = Data set for pre 5S changeover/setup times in seconds

Let VAR00043 = Data set for post 5S changeover/setup times in seconds

Table 18

Company A, Machine Two, Paired Samples

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00042	1487.1429	7	115.33347	43.59195
	VAR00043	1317.8571	7	156.43362	59.12635

Table 19

Company A, Machine Two, Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00042 & VAR00043	7	0.840	0.018

Table 20

Company A, Machine Two, Paired Samples Test

		Mean	Std. Deviation	Std. Error Mean	Upper	T	Sig. (2-tailed)
Pair 1	VAR00042 VAR00043	169.285	86.397	32.655	249.190	5.184	0.002

Examination of the paired samples test results at the 95% confidence interval significance of .002 is less than .05 so the change was significant and the null hypotheses was rejected for the alternative hypotheses. There was statistically a significant change in changeover/setup times on machine 2 at company A. Paired sample statistics show a pre 5S changeover/setup time mean of 1487 seconds or approximately 25 minutes and a post 5S implementation time of 1317 seconds, which is approximately 22 minutes, and another decrease in time.

T-Test Machine 3

Let VAR0045 = Data set for pre 5S changeover/setup times in seconds

Let VAR00046 = Data set for post 5S changeover/setup times in seconds

Table 21

Company A, Machine Three, Paired Sample Correlations

		N	Correlation	Sig.
Pair 1	VAR00045 & VAR00046	16	0.007	0.978

Table 22

Company A, Machine Three, Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00045	1397.187	16	131.980	32.995
	VAR00046	1112.125	16	209.677	52.419

Table 23

Company A, Machine Three, Paired Samples Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00045 VAR00046	285.062	246.932	61.733	153.481	416.643	4.618	.000

Looking at the paired samples test results at the 95% confidence interval at significance of .000 is less than .05 so I concluded that the change was significant and rejected the null for the alternative hypotheses. There was a statistically significant change in changeover/setup times on machine 3 at company A. Paired sample statistics

show that the mean decreased from a pre 5S implementation of 1397 seconds or 23.5 minutes to 1112 seconds, which is about 19 minutes. .

t-Test Machine 4

Let VAR0048 = Data set for pre 5S changeover/setup times in seconds

Let VAR00049 = Data set for post 5S changeover/setup times in seconds

Table 24

Company A, Machine Four Paired Sample Statics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00048	1517.583	12	81.080	23.405
	VAR00049	1206.833	12	62.988	18.183

Table 25

Company A, Machine Four, Paired Samples Statistics

		N	Correlation	Sig.
Pair 1	VAR00048 & VAR00049	12	0.433	0.160

Table 26

Company A, Machine Four, Paired Samples Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00048 VAR00049	310.750	78.211	22.577	261.056	360.443	13.763	.000

Examination of the paired sample test results at the 95% confidence interval revealed a significance of .000, which is less than .05 so I concluded that the change was significant. Thus, the null was rejected and the alternative hypotheses accepted. There was statistically significant change in changeover/setup times on machine four at company A.

t-Test Machine 5

Let VAR0051 = Data set for pre 5S changeover/setup times in seconds

Let VAR00052 = Data set for post 5S changeover/setup times in seconds

Table 27

Company A, Machine Five, Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00051	1722.818	11	111.040	33.479
	VAR00052	1486.273	11	68.336	20.604

Table 28

Company A, Machine Five, Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00051 & VAR00052	11	0.821	0.002

Table 29

Company A, Machine Five Paired Samples Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00051 VAR00052	236.545	67.348	20.306	191.299	281.791	11.649	0

Examination of the paired samples test results at the 95% confidence interval revealed that the significance is less than .05. Therefore, I concluded that the change was significant. The null hypothesis was rejected and the alternative hypothesis was accepted. There was a statistically significant change in changeover/setup times on machine five at company A. Changeover/setup times decreased from 1517 seconds or 25 minutes to 1206 seconds or 18.5 minutes.

T-Test Machine 6

Let VAR00054 = Data set for pre 5S changeover/setup times in seconds

Let VAR00055 = Data set for post 5S changeover/setup times in seconds

Table 30

Company A, Machine Six Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00054	1904.500	4	62.973	31.486
	VAR00055	1565.000	4	55.105	27.552

Table 31

Company A, Machine Six, Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00054 & VAR00055	4	0.337	0.663

Table 32

Company A, Machine Six, Paired Sample Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00054 VAR00055	339.5	68.295	34.147	230.825	448.174	9.942	0.002

Examination of the paired samples results at the 95% confidence interval revealed a significance of .002 which less than .05 so the change was significant. The null was rejected and the alternative was accepted. There is statistically significant change in changeover/setup times on machine 6 at company A. Times for changeover/setups fell from 1904 seconds or 31.5 minutes pre 5S to 1565 seconds or 26 minutes post 5S.

t-Test Machine 7

Let VAR0057 = Data set for pre 5S changeover/setup times in seconds

Let VAR00058 = Data set for post 5S changeover/setup times in seconds

Table 33

Company A, Machine Seven, Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00057	2055.800	5	86.693	38.770
	VAR00058	1677.600	5	93.208	41.684

Table 34

Company A, Machine Seven, Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00057 & VAR00058	5	0.966	0.008

Table 35

Company A, Machine Seven, Paired Samples Test

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00057 & VAR00058	378.2	24.386	10.905	347.920	408.479	34.678	.000

Examination of the paired sample test results at the 95% confidence interval showed a significance of .000 which is less than .05 so the change is significant and the null is rejected and the alternative is accepted. There is statistically significant change in changeover/setup times on machine 7 at company A. In addition, for paired sample statistics mean, there was a decrease from 2055 seconds or 34 minutes pre 5S to 1677 seconds, or 28 minutes post 5S.

Company B z-Test

Let VAR00001 = Data set for pre 5S changeover/setup times in seconds

Let VAR00002 = Data set for post 5S changeover/setup times in seconds

Table 36

Company B Production Machine Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00001	1671.588	34	193.601	33.202
	VAR00002	958.588	34	56.821	9.744

Table 37

Company B Production Machine Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00001 & VAR00002	34	-0.363	0.035

Table 38

Company B Production Machine Paired Samples Test

		Paired Differences					Z	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00001 VAR00002	713	220.688	37.847	635.998	790.001	20.605	.000

Examination of the paired sample test results at the 95% confidence interval at significance of .000 is less than .05 so the change is significant and the null is rejected and the alternative is accepted. There is statistically significant change in changeover/setup times on the production machine at company B. At this company there was decrease change in sample statistics mean changeover/setup time pre 5S of 1671 seconds or 28 minutes to 958 seconds or 16 minutes post 5S.

Company C t-Test

Let VAR00001 = Data set for pre 5S changeover/setup times in seconds

Let VAR00002 = Data set for post 5S changeover/setup times in seconds

Table 39

Company C, Machines A and B Combined Data, Parried Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00001	196.666	9	10.259	3.419
	VAR00002	199.666	9	6.519	2.173

Table 40

Table 40. Company C, Machines A and B Combined Data, Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00001 VAR00002	9	0.03	0.939

Table 41

Company C, Machines A and B Combined Data, Paired Samples Test

		Paired Differences					T	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	VAR00001 VAR00002	-3	11.989	3.996	-12.216	6.216	-0.751	0.474

There are two production machines with changeover/setups at company C. However because the changeover/setup times where so similar (little to no time variance between the data collected for both machine A and B) they could be grouped together into one data based on Urdan, 2010. Looking at the paired sample test results at the 95% confidence interval at significance of .474 is greater than .05 so I concluded that the change is not significant. Here the null was accepted and the alternative hypothesis was rejected. There was not a statistically significant change in changeover/setup times on machines at company C. The change in paired sample statistics mean changeover/setup time from pre 5S to post 5S was only 3 seconds and was actually an increase in time from 196 seconds to 199 seconds.

Combined Overall Statistics – ANOVA F-Test

Let VAR00001 = Data set for pre 5S changeover/setup times in seconds

Let VAR00002 = Data set for post 5S changeover/setup times in seconds

Table 42

Companies A, B, and C Combined Data Descriptive Statistics

	Mean	Std. Deviation	N
VAR00001	1492.900	458.307	110.00
VAR00002	1108.518	358.537	110.00

Table 43

Companies A, B. and C Combined Data, Measure Estimates

	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
VAR00001	1492.9	43.698	1406.292	1579.508
VAR00002	1108.518	34.185	1040.764	1176.272

Table 44

Companies A. B. and C Combined Data, ANOVA Tests of Between-Subject Effects

(transformed variable: average)

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.	Partial Eta Squared
Intercept	3.72E+08	1	3.72E+08	1278.716	.000	0.921
Error	31727478.000	109.00	291077.800			

Examination of the test of between-subjects effects results at the 95% confidence interval the significance of .000 is less than .05 so the change was significant and the null was rejected and the alternative was accepted. Overall when looking at all the data pre and post treatment, collected as one paired set, there is a statistically significant change in changeover/setup times. The mean changeover/setup times decreased from a mean of 1492 seconds or 25 minutes pre 5S to 1108 seconds or 19 minutes Post 5S.

Summary

For all three companies, individually there were changes in machine changeover/setup times and those changes were statistically significant with the exception of company C, which individually did not have a statistically significant change. However, when all the data were combined into one overall analysis, the change was statistically significant so from that pre-experiment there was enough support to reject the null and accept the alternative hypotheses.

Chapter 5 following is an interpretation of the findings how they relate to previous existing research described in chapter two. Chapter 5 will also contain the limitations of the study as well as recommendations. The chapter ends with implications and conclusions for the study.

Chapter 5: Discussion, Conclusion, and Recommendations

The purpose of this study was to determine if increased understanding of 5S translated into a change in production machine changeover/setup times when 5S is used in U.S. manufacturing and if any change is statistically significant. I was interested to find out if implementing 5S has the same effect on U.S. companies that it has on companies in other countries where 5S is widely used. The design for this study was the quantitative pre-experimental design one-group pretest-posttest. I selected a pre-experimental design because I could not find any companies to use as control groups. In addition, I selected a quantitative approach with a one-group pre-post design because I could use statistical analysis to test my hypothesis. This pre-experimental research could only indicate if 5S when implemented caused a change in the studied pre and post 5S changeover/setup times and statistical significance existed in all cases expect one when 5S was implemented in the three companies I conducted research individually and then as a combined group. I found statically significant changes to the machine changeover/setups on production machines at two of the companies and on all data when combined together.

Interpretation of Findings

With nine of the 10 machines and all the overall result of the combining of data from all 10 machines measured showed a statistically significant change to production machine changeovers/setup times and those statistically significant changes in times being a decrease from pre 5S treatment to post 5S treatment. These results seem to confirm Ohno's theory that the elimination of waste in manufacturing reduces manufacturing cost. By reducing the amount of time spent on changeovers/setups the amount of overhead that goes into manufacturing a product is reduced. That reduction in

overhead cost goes directly to reducing total manufacturing product cost. From this study, I can state that when waste is reduced in manufacturing through the implementation of 5S, at the three companies studied, there is a statistically significant change in time the amount of time required to perform the production machine changeover/setups and that change was a decrease in time.

The reduction in time could be due to the treatment, which was a training on 5S that I gave every employee at each of the participating companies. This training may have been the cause of the resulting waste reduction activities involved in implementing and maintaining 5S that each of the companies performed. Without a control group, I cannot say for sure that the training caused the improvement. Some other outside force could have caused the change but I am not able to say without the control group. However, a decrease in the amount of time spent on changeover/setups could lead to shorter times to fill customer orders. Shorter time to fill orders. It also means less overhead costs such as electricity to operate or employee time/wages going into final cost of production to fill an order. This in turn would reduce overall final finished order manufacturing cost.

Implementing 5S could possibly lead to greater employee satisfaction and thus possibly increased employee output. This is something that was not researched in this study. A reduction in waste in the manufacturing process and on the manufacturing floor could make it easier for employees to find things and ensure that good working tools are available at the point of use when needed. All of this should improve employee satisfaction. In a more comprehensive field study, I would be able to measure employee satisfaction before and after 5S.

Limitations of the Study

One limitation was that the population and samples were restricted to manufacturing companies in the Salem and Portland cities of Oregon. As stated previously, money was not available for me to go anywhere that would require travel of any significant distance. Secondly, there could have been a Hawthorne effect because I had to be visible on the shop floor while obtaining data. The act of being visible to those performing the machine changeover/setups being measured could have changed the way the performed. Thus, the results might have been different from what they would have been if I were not visible on the floor. Being visible could have, for example, changed the speed at which the people doing changeover/setups performed those changeover/setups. However, there was no way for me to avoid a possible Hawthorne effect as it was necessary to be as close as possible to the action while collecting data. I needed to have a clear view of the changeover/setup processes in order to obtain accurate measurements. I do not know, conclusively, there was or was not a Hawthorne effect that had an impact on my findings.

Another limitation was training. If the training and copies of the PowerPoint slides given to every employee at all three companies was not sufficient for the participants to learn 5S, the company may not have implemented it properly. However, as I personally observed, all three companies did implement 5S properly. All of the steps in 5S where followed and they reached a point to where they were properly maintaining 5S. A final limitation is that results of this research are not generalizable to other companies because a random selection was not done. The three companies cannot be construed as representative of all companies in U.S. manufacturing. They cannot even be construed as representative of all companies in the region from which they were drawn. Especially

since the three companies where not randomly selected. Thus, the not generalizable result was a real limitation assumed in the proposal that existed in the final research.

These were the limitations assumed before the study was conducted and were the only limitations that existed in the study. Nothing new arose in the conducting of the study. Everything in the study went as planned and stated in the proposal.

Recommendations

Based on the results of this pre-experimental study, I believe that a full field study with both experimental and control groups is warranted. Because a statically significant decrease in changeover/setup times was found in all but one of the data sets, analysis of the evidence suggest that when 5S is implemented properly it might have a statistically significant impact on manufacturers needing machine changeover/setups. Changeover/set up time should be investigated further on a broader scale across the U.S. and in more than just three types of manufactures. The use of experimental and control groups on a broader scale would be more useful to manufacturers. Randomly selecting participants from all over the U.S. would give a clearer picture of the results of a similar study across all of the U.S.. It would not localize results to one small pocket of the U.S. where challenges to manufacturing in the U.S. many exist that don't exist in other parts of the U.S. If all the data from each company randomly selected across the entire U.S. was combined, with a control and experimental group, into one data set it would give a clear picture if, and if so, how implementing 5S in U.S. manufacturing companies affects and their bottom cost of producing goods and thus their ability to be competitive in a gloabal economy.

Further research studies should have a control group, which would allowing for a more precise determination if any change to changeover/setup times is actually caused by the 5S training that allows companies to be able to fully and correctly implement 5S. A

researcher, for example, could study production numbers over a period of time after 5S had been implemented and properly maintained to see if they are increasing, decreasing or staying the same. If it were found that production numbers were increasing over a fixed period, measured before and after 5S implementation it would help to confirm Ohno's theory that this research was based on hold true in U.S. manufacturing. It would mean that the amount of overhead going into filling a customers order was decreasing due to the increased production throughput and lowering the cost to produce goods in the U.S..

Further studies could also try to determine why more manufactures are not implementing 5S. In the review of existing research and literature on 5S, I found that many U.S, companies when they try 5S and do not quickly see the results, they think they should ended up dropping 5S. A further research study could include what could be done to get more U.S, companies to use 5S and stick with it.

Implications

The research impact of positive social change is highlighted by advancing U.S. manufacturers' knowledge of 5S. 5S has the potential for increased profits and is a benefit for manufactures, in the U.S. An Increase in profits helps drive a healthier economy. Increased profits and an overall healthier company could also lead to greater employee satisfaction. In turn, an increase in profits could lead to greater employee participation in 5S, even more profits, and be an even stronger driver of the U.S. economy. This would make U.S. manufacturing more competitive in the global economy.

Because the findings of this research show there is in fact a change to changeover/setup times on production machines when 5S is implemented the potential is there for companies to have more up time for production. More up time for production

would mean increased profits. However, because this was a pre-experiment design it is difficult to project the results broadly. To be generalizable, a much broader study with a random sample of different kinds of companies would be needed. This way the results could clearly indicate if the change in time is an increase or decrease as well as be generalizable to the large population of manufactures in the U.S. as a whole.

Since many manufacturers may not be as efficient and as effective as they could be, the use of 5S might be a way to make manufactures better. If a manufacturer is more efficient and effective, the company profits, the employees profit and society profits. The implementation of 5S in more companies might be a strong social change because of the increase in productivity. Additionally U.S. productivity increases may help the economy because more goods are available for consumption that are made in America at prices that may be more competitive with those manufactured in other countries. More competition is always good for society as a whole because it drives prices of goods lower. More U.S. made good being sold also increases U.S. companies' profits.

Increased production and profits could also produce happier employees. This would also be a benefit to society. Happier people tend to lead healthier people, which is a savings to the individual on medical costs. This then would befit society by leaving individuals with more disposable income to spend on consumer goods, further driving the U.S.'s consumer economy.

It could also lead to a start towards working to reduce the trade deficit that the U.S. has been in with China since 1985 or later. According to the census.gov web site, the U.S. had been importing millions of U.S. has been importing millions of U.S. dollars more in goods than they have been exporting to China as far back as 1985. Looking closer at the census.gov website, it also shows millions of U.S. dollars in trade deficit

with Japan since at least 1985. There might be many other countries where cost of producing goods is cheaper that in the U.S. and trade deficits exist. However, if companies in the U.S. were to implement 5S and become more competitive with lower cost producers, then it would help toward a possible reduction in those trade deficits.

There is also a potential, that implementing 5S could reduce injuries in U.S. companies. Cleaner and better organization of work spaces comes with implementing 5S. This could lead to employees that are more aware of their surroundings, as less cluttered environments are easier to see and move around in and employees might become more aware of their surroundings and to what they are doing and less likely to have a work place injury/accident. This is something that a fuller field study could look at by examining data from before 5S and a year after 5S has been fully implemented.

Additionally, for a company being better organized means they are less likely to lose things or need multiples of an item and have good working tools in easy to find locations. In a better organized work place where things are easy to find there are fewer requests of employees asking for replacement tools. Tools that may be needed just because the one that exists in the plant is lost or not put away where everyone that needs it has access to it.

Conclusions

As the researcher performing every aspect of this research, I had hoped to be able to do a full field study with a control and experimental group. As the design and participants, time and money started coming together for this research, I realized I was not going to be able to make my hopes a reality. The best I could hope for is what I got, the indication that a full field study would be worth the time and money for someone who has it. U.S. manufacturing lacks competitiveness in the global market it must compete in.

5S according to research in other countries has reduced manufacturing cost of products and improved production efficiency among other benefits. This research shows that at least during the time I monitored the companies' 5S efforts and performed the overall research there was the potential for the same results in U.S. manufacturing and thus a full field study should be conducted to actually confirm these results in production machine changeover/setup times.

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Appendix A: Hutchins's 2006 research results

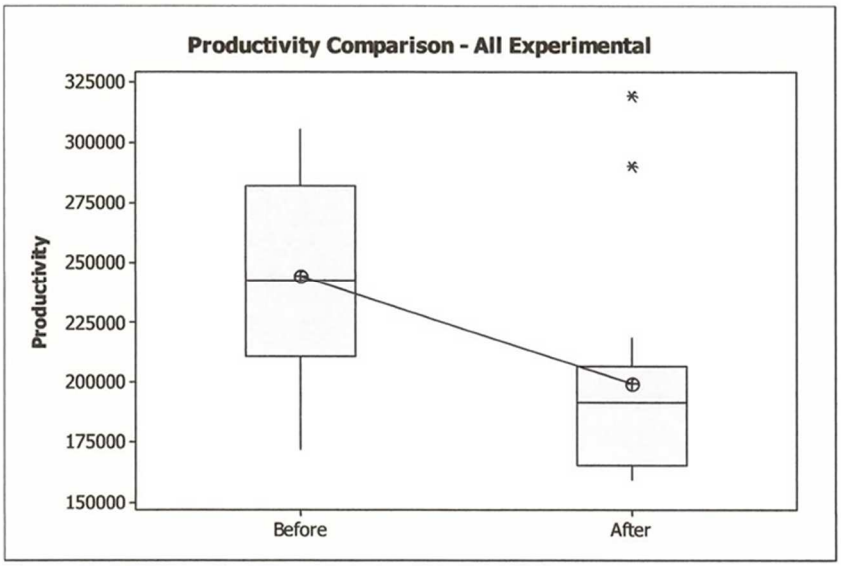


Figure A1. Results of ANOVA analyses for combined product output per hour of the departments in the experimental group indicating a significant reduction in productivity after 5S implementation. Reprinted from *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 81, by C. Hutchins, 2006, unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

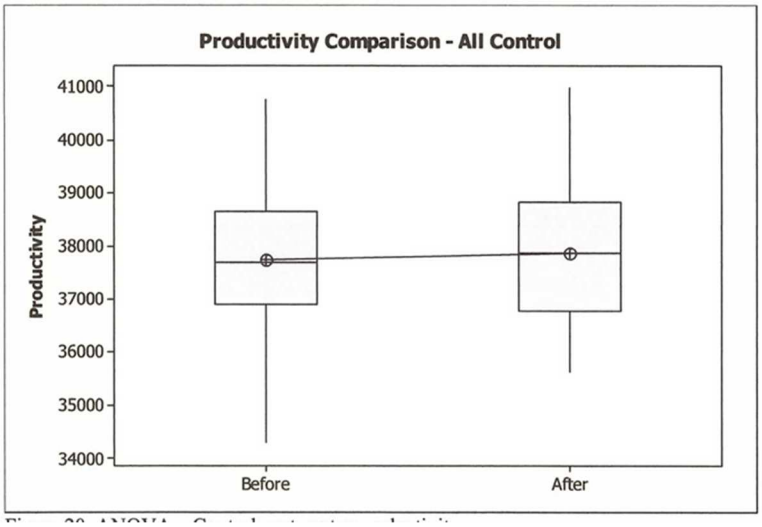


Figure A2. Results of ANOVA analyses for all control group departments indicating a slight increase in productivity. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 82, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

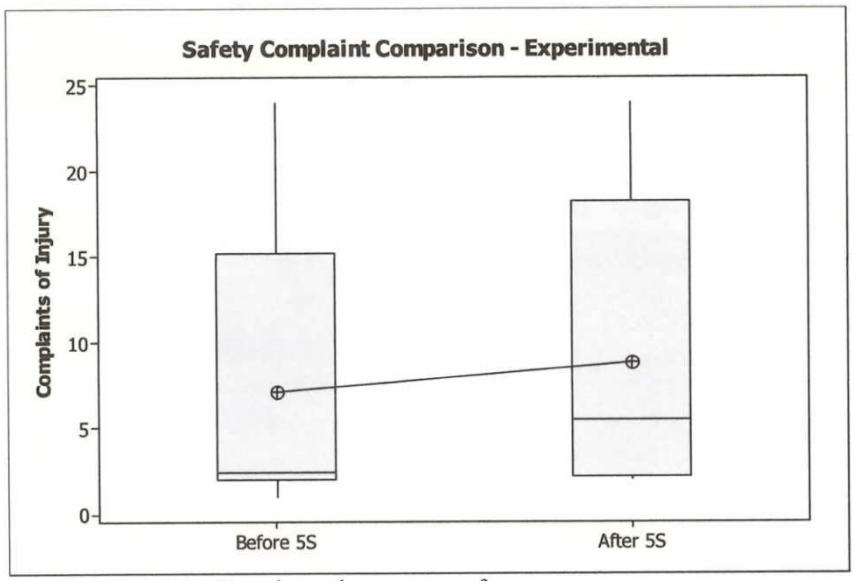


Figure A3. Results of ANOVA of the number of safety accidents reported in the experimental group before and after 5S implementation. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p.50, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

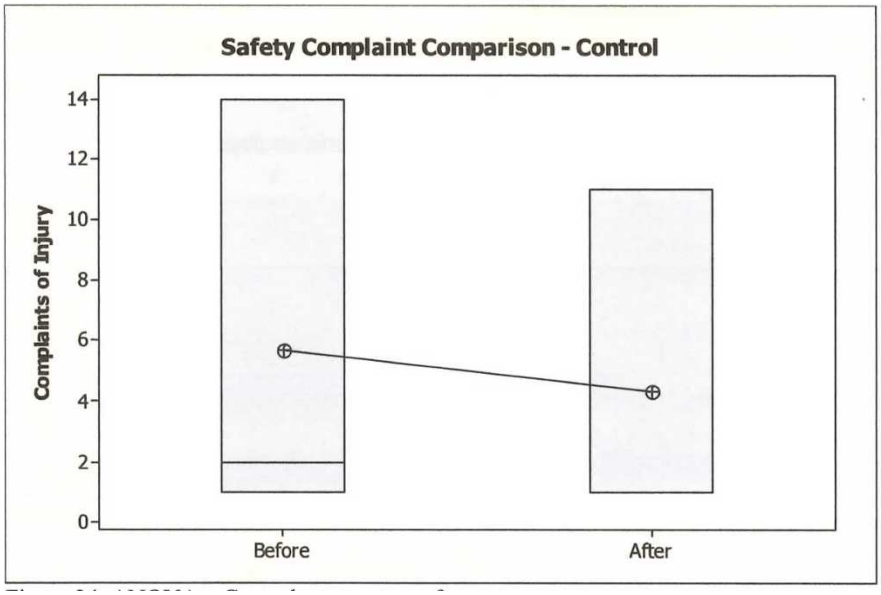


Figure A4. Results of ANOVA analysis for the number of safety accidents reported in the control group after 5S implementations From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p.51, by C. Hutchins, 2006, unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

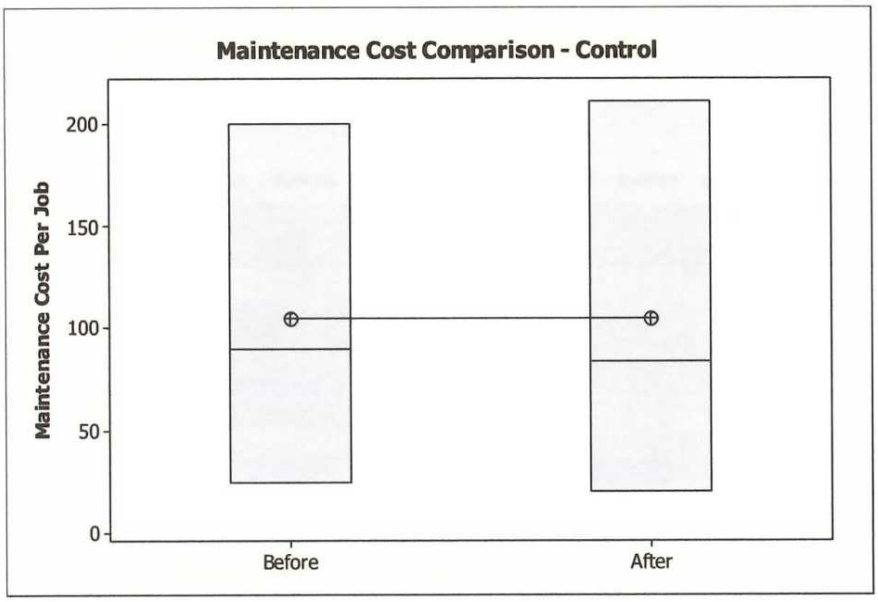


Figure A5. Results of ANOVA analysis for maintenance cost for the control group during the experimental period. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 59, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

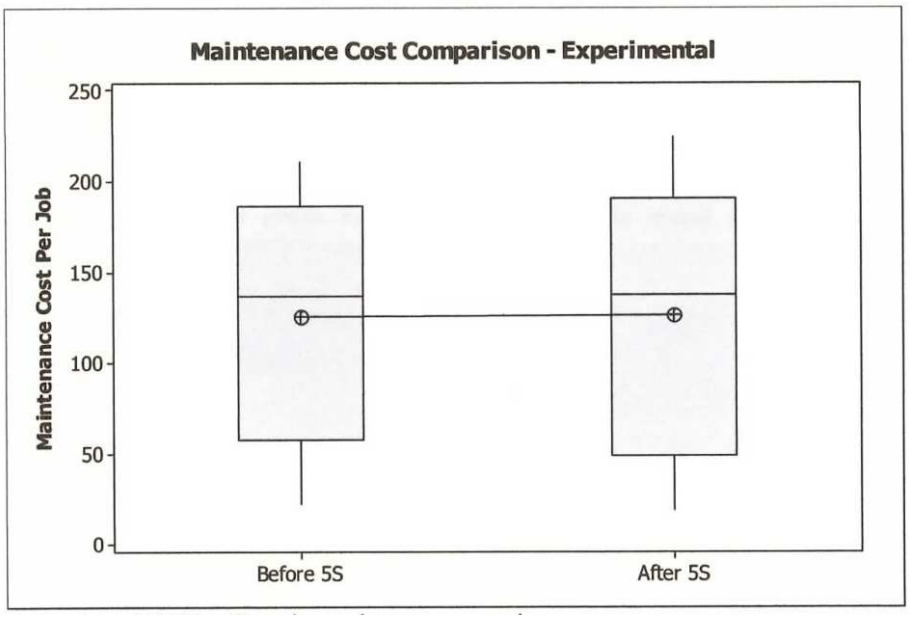


Figure A6. Results of ANOVA analysis for maintenance cost of the experimental group before and then after 5S initiative. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 59, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

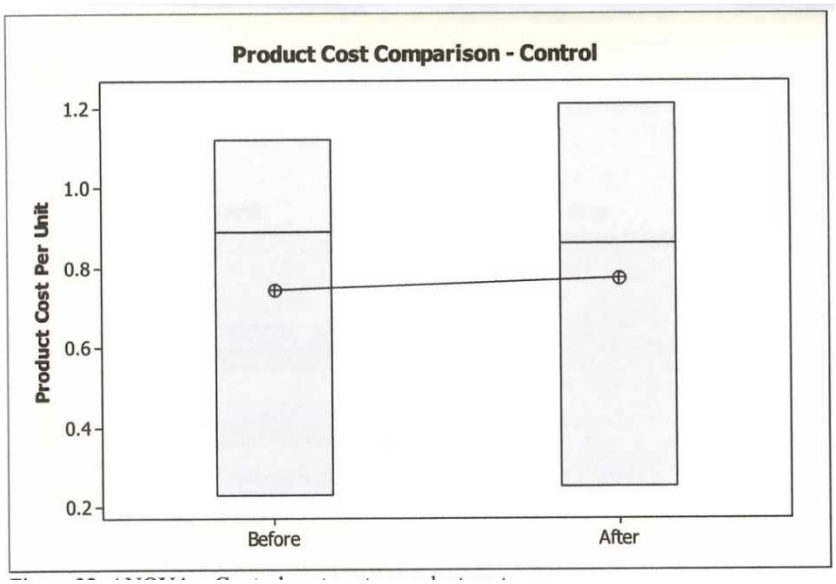


Figure A7. Results of ANOVA analysis of cost of the product in the control group. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 57, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

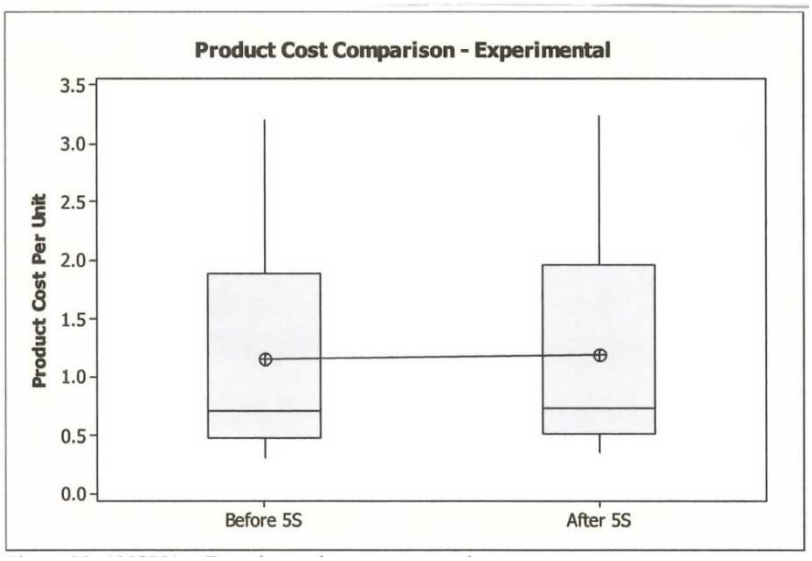


Figure A8. Results of ANOVA analysis change in cost of the product in the experimental group before and after 5S implementation From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 56, by C. Hutchins, 2006, unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

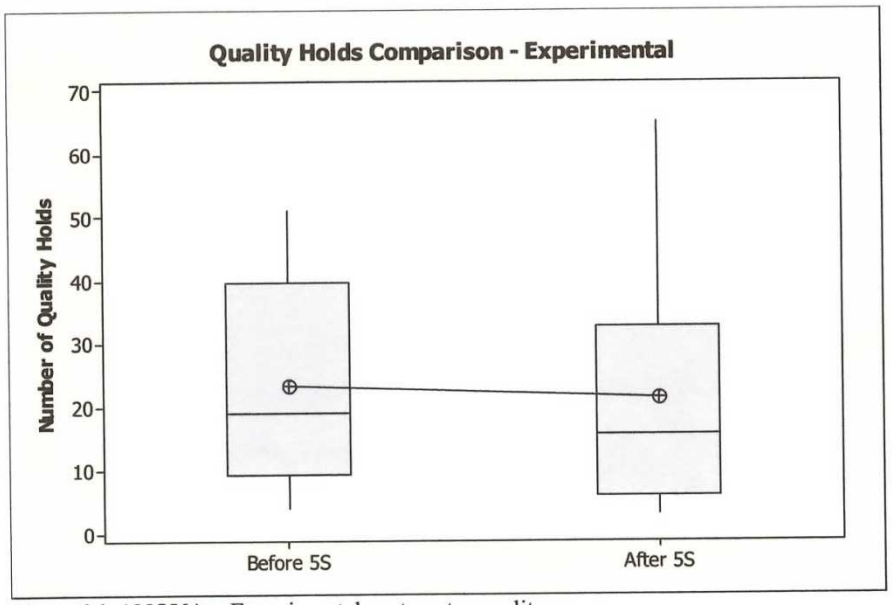


Figure A9. Results of ANOVA analysis holds for quality before and after 5S implementation. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 53, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN.

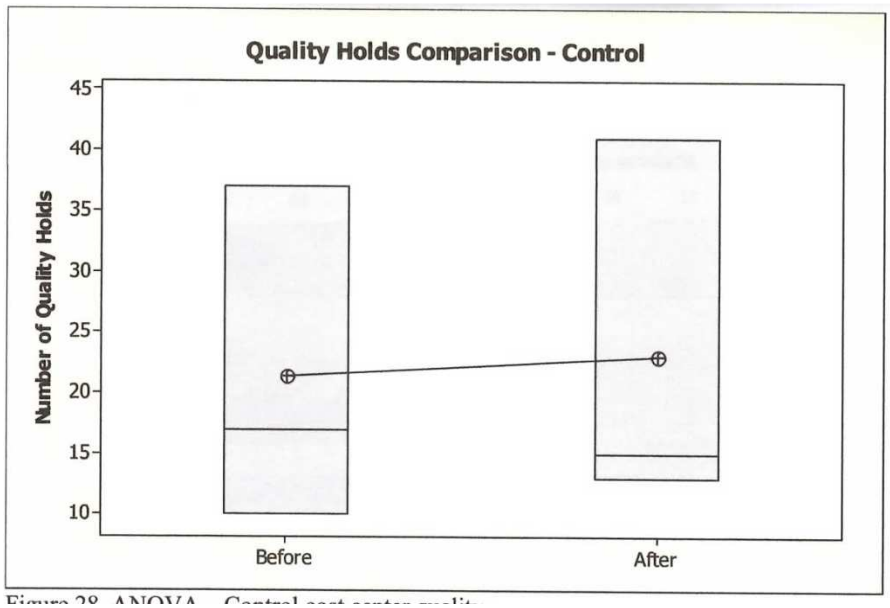


Figure A10. Results of ANOVA analyses for holds for quality during 5S experiment time frame for the control group. From *Five "S" improvements system: an assessment of employee attitudes and productivity improvements* p. 53, by C. Hutchins, 2006, Unpublished doctoral dissertation, Cappella University, MN. Copyright 2006 by Hutchins.

Appendix B: Permission Request to use Fgure 1

permission to use some of your work

Inbox x

Jan 9

Nicole Schra-Martin nicolelschramartin@gmail.com

to pascal.dennis

I would like permission to use the figure on page p.19 of your 2007 work Lean production simplified in my Ph.D. dissertation literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

Pascal Dennis pascal.dennis@leansystems.org Jan 9

to me

OK

Appendix C: Permission to use figure 2

Permission Request

Inbox X

Jan 10
[redacted]

to me

Nicole,
You have my permission to use the figure on page 391.

Good luck!

Best regards,

Larry Rubrich
WCM Associates LLC
www.wcmfg.com
Office [redacted]
Fax [redacted]
Cell [redacted]

To Improve - You– Must Change

----- Original Message -----

From: Nicole Schra-Martin

To: info@wcmfg.com

Sent: Thursday, January 09, 2014 4:30 PM

Subject: Need to contact Larry Rubrich

I am a Ph.D. student and trying to get hold of Larry Rubrich. I would like to ask permission to use the figure on page 391 of Implementing world class manufacturing in the literature review section of my dissertation.

Nicole L. Schra-Martin
Ph.D. Candidate Walden University

Appendix D: Permission request to use Enna 5S audit form

Permission to use 5S audit form

Inbox x

April 20

Nicole Schra-Martin nicolelschramartin@gmail.com

to info@enna.com

I would like permission to use your 5S audit form as part of my research data collection for my PhD.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

info@enna.com April 25

to me

Yes you certainly have our permission to use our 5S audit form.

Tyler Wilson

Appendix E: Permission to use Tables 3, 4 and 5

Permission to use some of your work

Inbox X

July 22

Nicole Schra-Martin nicolelschramartin@gmail.com

to Brian Leonard

I would like permission to use the tables from of your 2007 master thesis in my Ph.D. dissertation in my literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

Brian Leonard August 18

to me

You may use whatever material you need for your work. Thanks for checking.

Best of luck with your PhD.
Brian Leonard

Appendix F: Permission to use Tables 6, 7, 8, 9, and 10

Permission to use some of your work

Inbox X

Nicole Schra-Martin nicolelschramartin@gmail.com Sept 5

to Adana Bayno-Morines

I would like permission to use the tables from your 2008 work published in the International Journal of Quality and Reliability Management, 27(2).

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

Adana Bayno-Morines Septeber 22

to me

Sorry so long to get back to you. I just found this email. You have all of authors permission to use whatever you want from article.

Adana Bayno-Morines

Appendix G: Permission to use Table 11

Permission to use some of your work

Inbox X

March 10

Nicole Schra-Martin nicolelschramartin@gmail.com

To Baalad Deror; Tommy Jun; Rahman Mohd

I would like permission to use the table from your work Benchmarking technique in lean manufacturing (5S) practice, in my Ph.D. dissertation literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

Tommy Jun

March 20

to me

You can use or work.

Appendix H: Permission to use Table 12

Permission to use some of your work

Inbox X

July 22

Nicole Schra-Martin nicolelschramartin@gmail.com

to Abbas Ghodrati; Noordin Zulkifli

I would like permission to use the figure on page 47 of your article in the International Journal of Business in my Ph.D. dissertation literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

to me

Abbas Ghodrati August 18

to me

Yes

Abbas Ghordati

August 19

Nicole Schra-Martin nicolelschramartin@gmail.com

To Abbas Ghodrati

Do you speak for Noordin Zulkifli as well?

Abbass Ghdati August 20

to me

What do you mean?

August 22

Nicole Schra-Martin nicolelschramartin@gmail.com

Do I have Noordin Zulkifli's permission to use the work as well? The email address I got for him seems to not be right. It returns an error that the address is not valid.

Abbass Ghdati August 26

to me

Yes you have his permission.

Appendix I: Permission to use Figures 4, 5, 6 and table 14

Permission to use some of your work

Inbox X

July 22

Nicole Schra-Martin nicolelschramartin@gmail.com

to Lary Lynch

I would like permission to use the graphs from your dissertation in my Ph.D. dissertation literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

to me

Larry Lynch July 24

to me

Yes you may. I would be interested in seeing what you are studying if it is also 5S.

Lary Lynch

Appendix J: Permission to use data in Appendix A

Permission to use some of your work

Inbox X

July 22

Nicole Schra-Martin nicolelschramartin@gmail.com

to Chris Hutchins

I would like permission to use the figures from your doctorate dissertation in my Ph.D. dissertation literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

to me

Chris Hutchins

to me

Yes you may use the graphs from my dissertation in your literature review for your disseratation.

Chris Hutchins

Appendix K: Permission to use Figure 3

Permission Request

Permission to use some of your work

Inbox X

July 22

Nicole Schra-Martin nicolelschramartin@gmail.com

to Brian Leonard

I would like permission to the use table on p. 24 of your masters thesis in my PhD literature review section.

Nicole L. Schra-Martin

Ph.D. Candidate Walden University

Brad Benjamin August 1

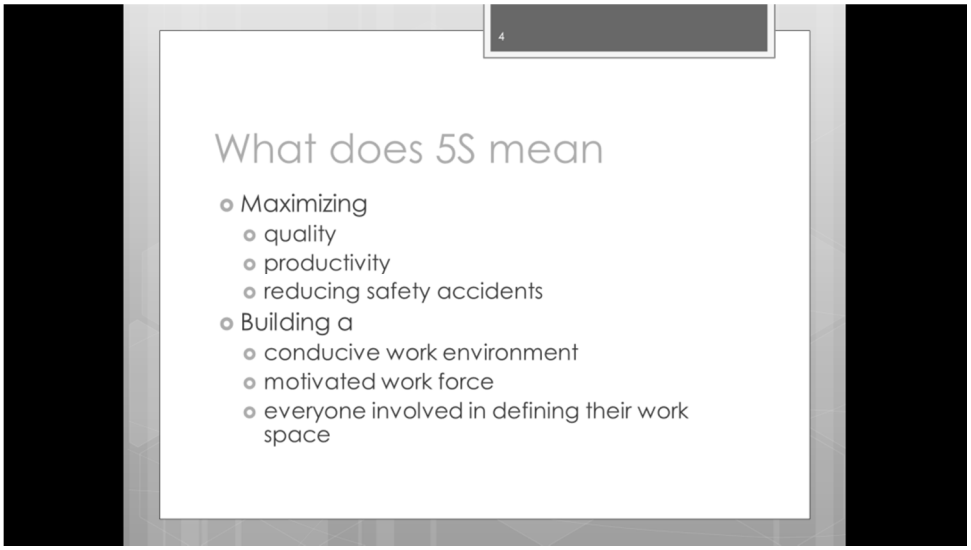
to me

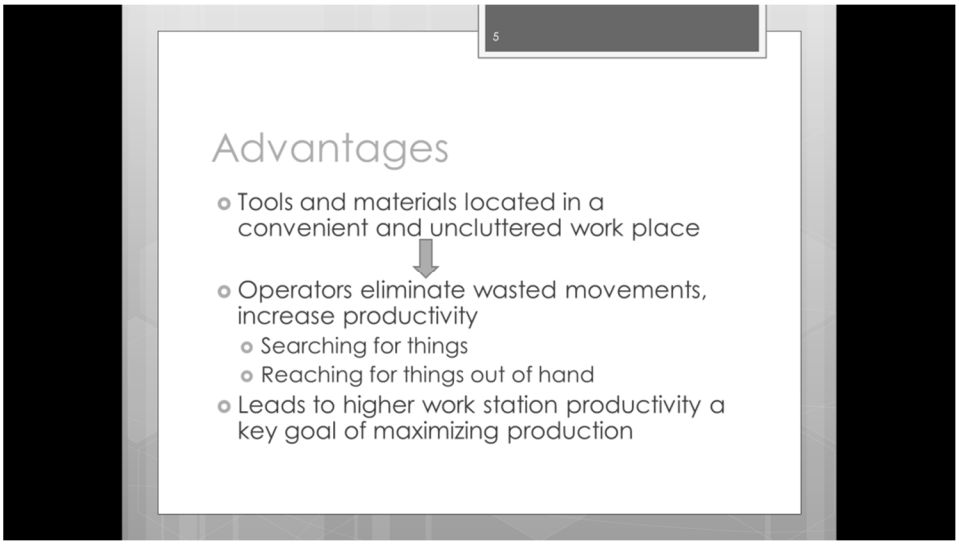
You may use my work as needed in your PhD.

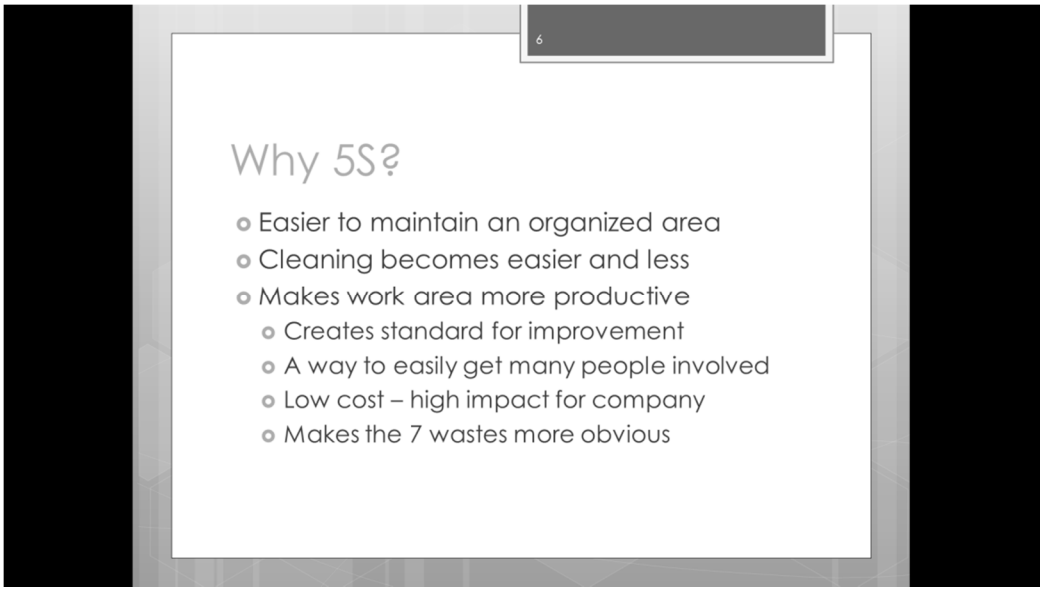
Brad Benjamin

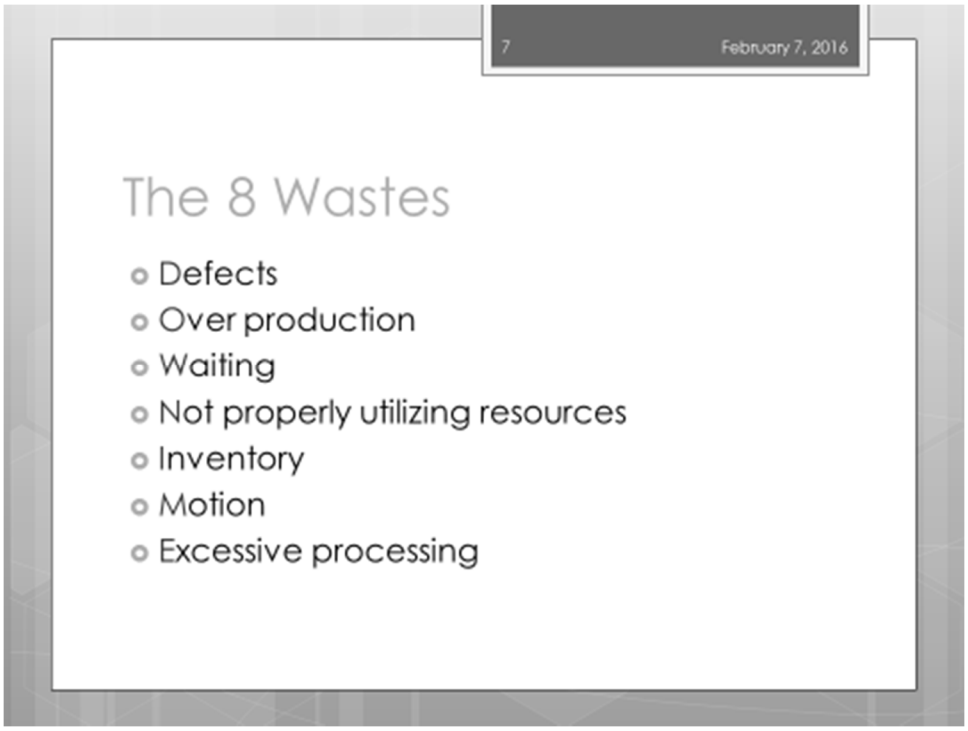
Appendix L: Treatment PowerPoint Presentation Delivered to Study Participants

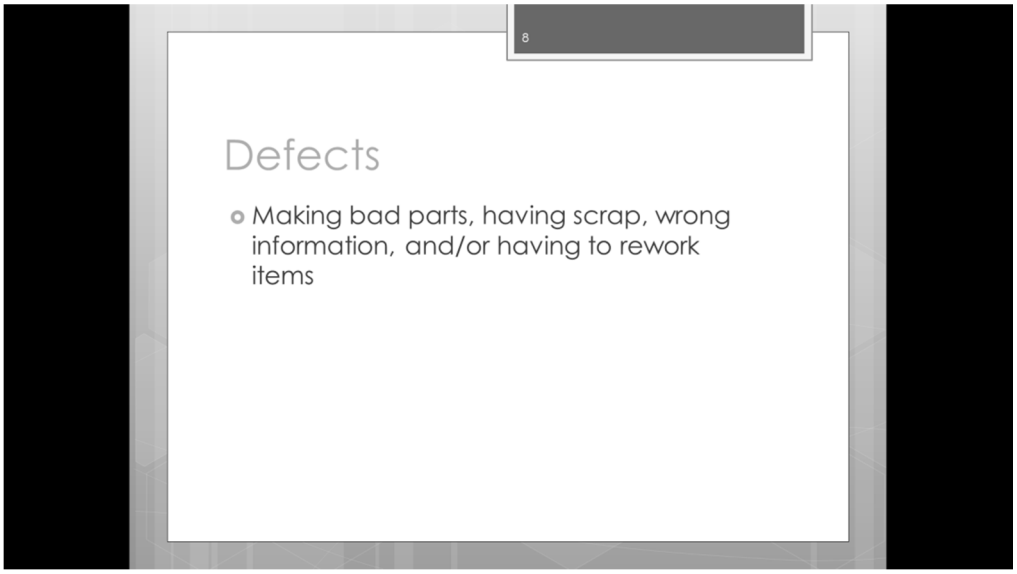

3
What is 5S
Foundation for all quality initiatives
Continuous Improvement
Lean Manufacturing
Simplest form of all quality tools and techniques


4
What does 5S mean
Maximizing
quality
productivity
reducing safety accidents
Building a
conducive work environment
motivated work force
everyone involved in defining their work space

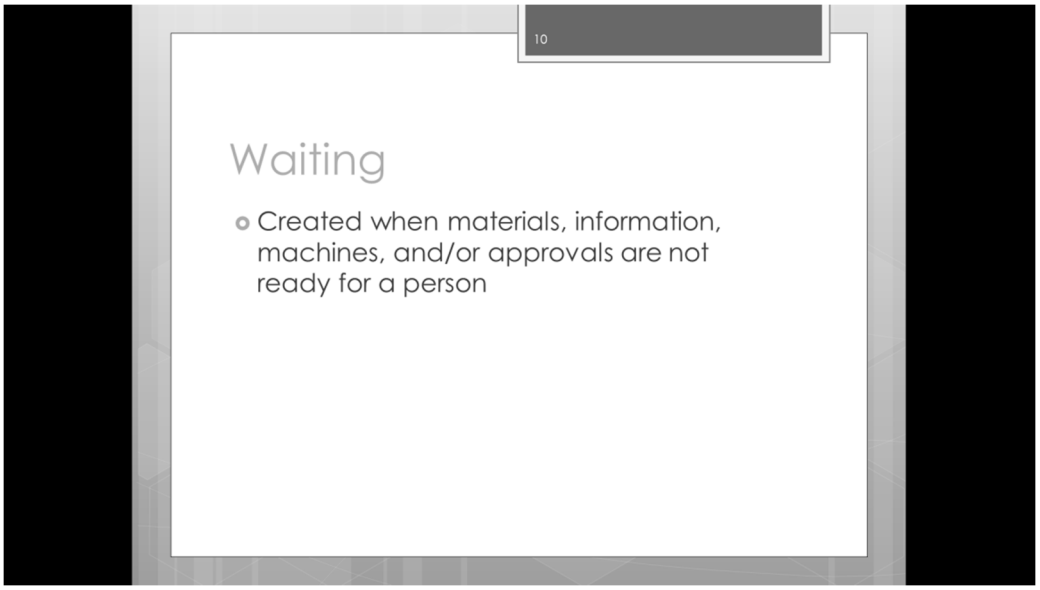

5
Advantages
Tools and materials located in a convenient and uncluttered work place
Operators eliminate wasted movements, increase productivity
Searching for things
Reaching for things out of hand
Leads to higher work station productivity a key goal of maximizing production

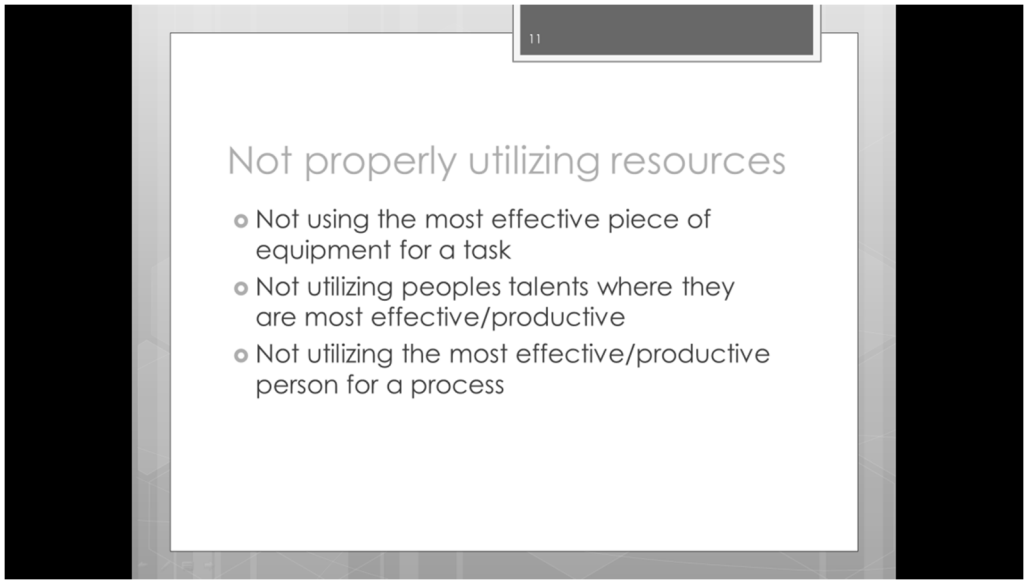

6
Why 5S?
Easier to maintain an organized area
Cleaning becomes easier and less
Makes work area more productive
Creates standard for improvement
A way to easily get many people involved
Low cost – high impact for company
Makes the 7 wastes more obvious


7
February 7, 2016
The 8 Wastes
Defects
Over production
Waiting
Not properly utilizing resources
Inventory
Motion
Excessive processing

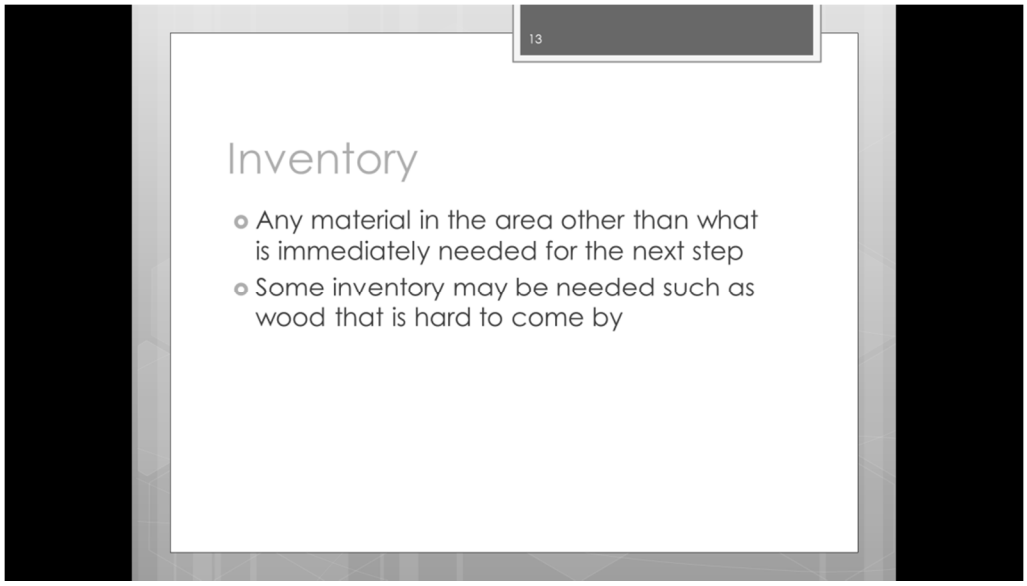

8
Defects
Making bad parts, having scrap, wrong information, and/or having to rework items

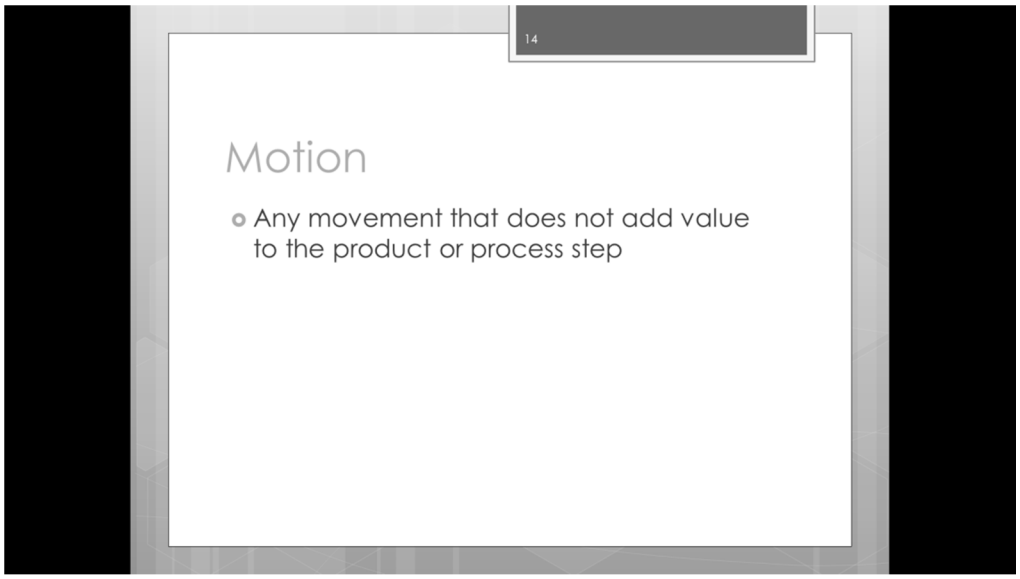

9
Over production
Making more products than the next process requires

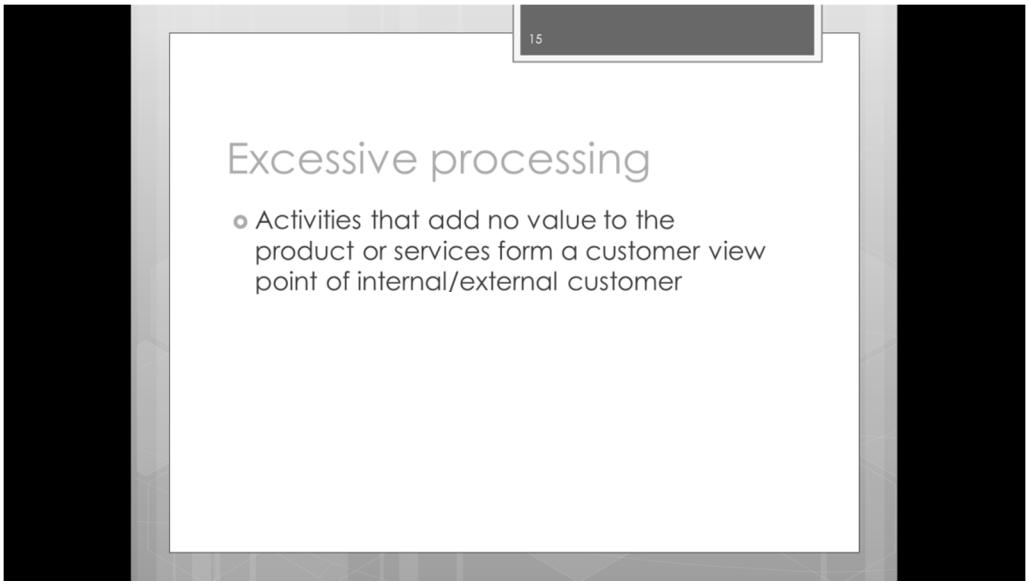

10
Waiting
Created when materials, information, machines, and/or approvals are not ready for a person


11
Not properly utilizing resources
Not using the most effective piece of equipment for a task
Not utilizing peoples talents where they are most effective/productive
Not utilizing the most effective/productive person for a process

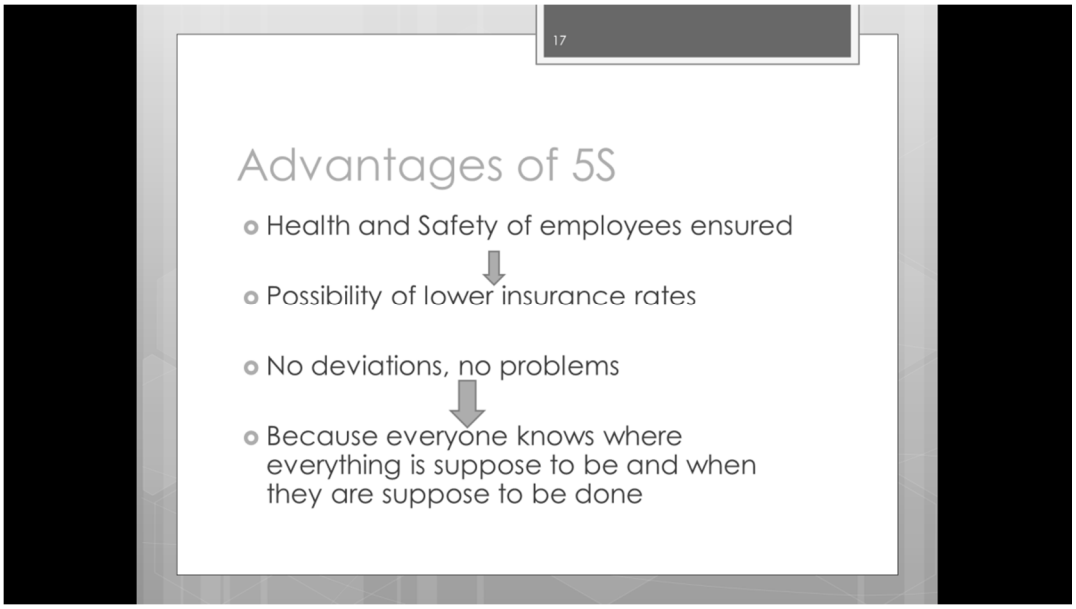

12
Transportation
Moving materials from one area to another

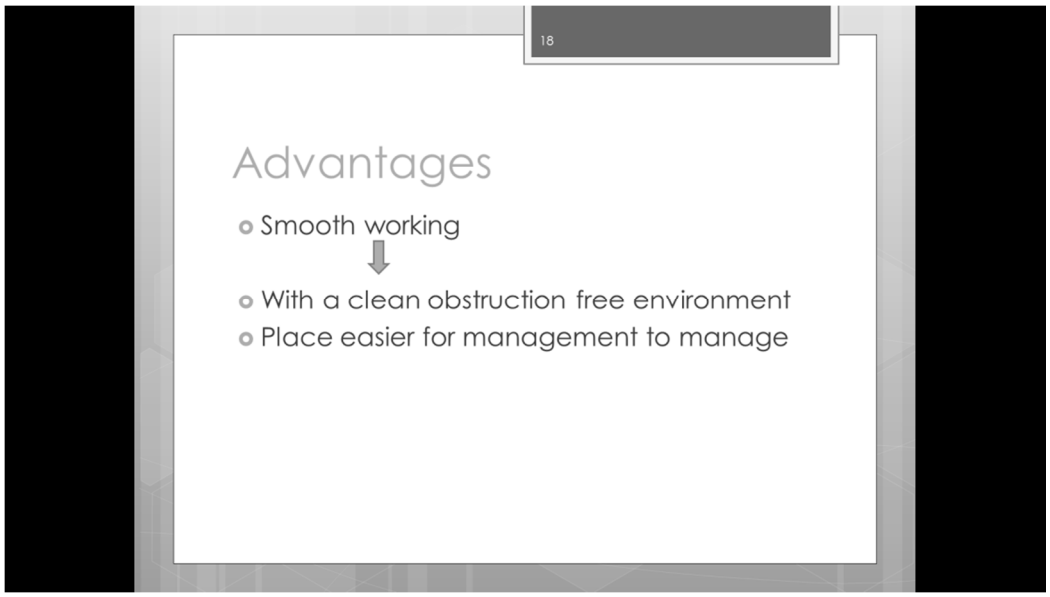

13
Inventory
Any material in the area other than what is immediately needed for the next step
Some inventory may be needed such as wood that is hard to come by


14
Motion
Any movement that does not add value to the product or process step

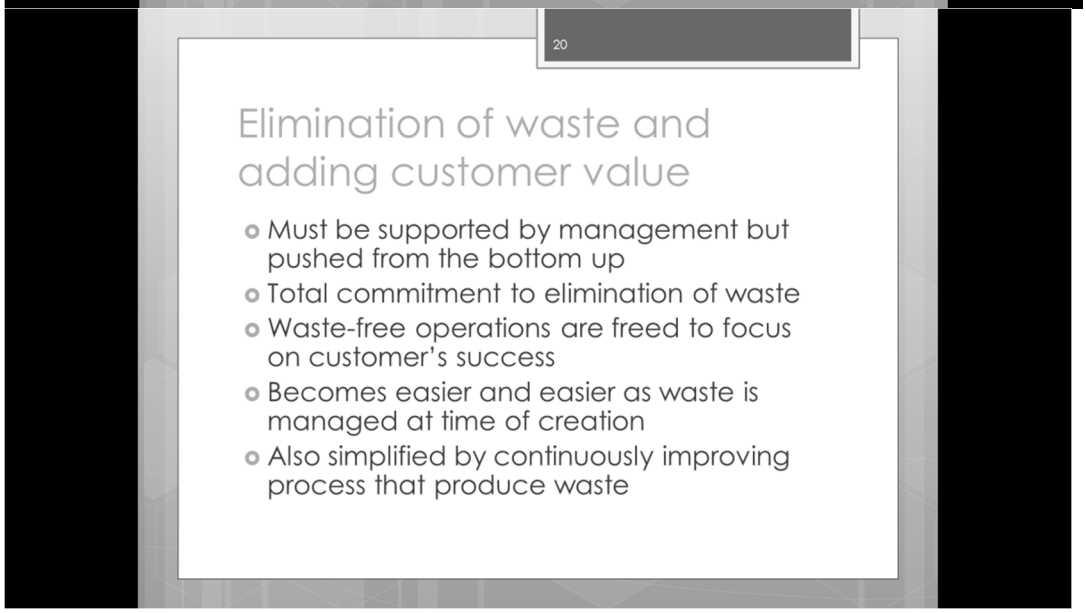

15
Excessive processing
Activities that add no value to the product or services form a customer view point of internal/external customer


16
Advantages of 5S
Clean and tidy work environment
Increased worker safety
Greater employee wellbeing
Increased motivation
Improved company image


17
Advantages of 5S
Health and Safety of employees ensured
Possibility of lower insurance rates
No deviations, no problems
Because everyone knows where everything is suppose to be and when they are suppose to be done


18
Advantages
Smooth working
With a clean obstruction free environment
Place easier for management to manage

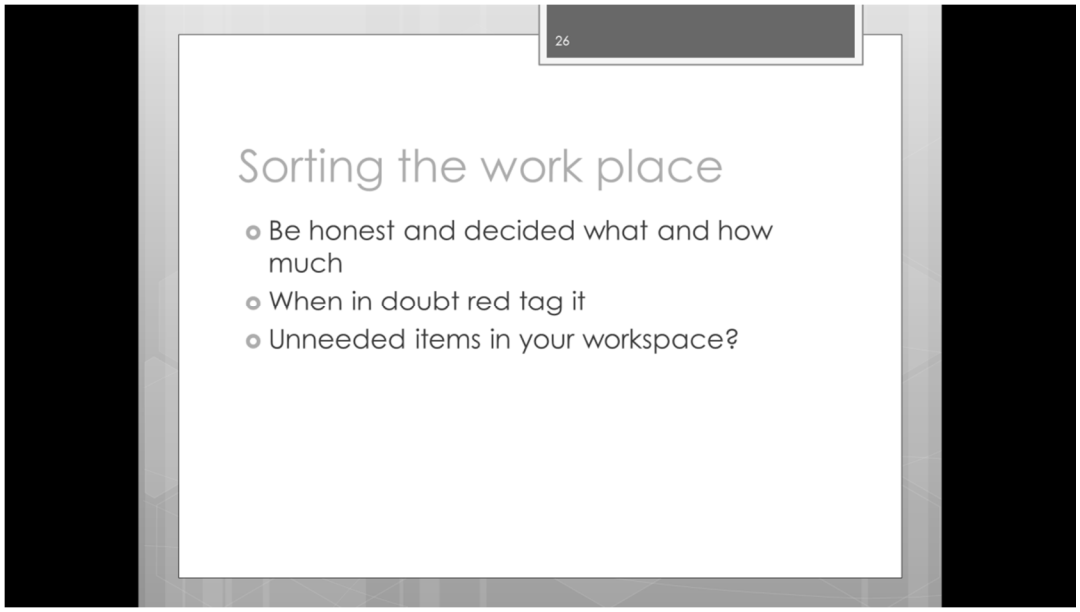

19
Advantages
Saves time
Speeds retrieval
Speeds changeovers
Accidents and mistakes minimized
Increased floor space
Endears work place ownership by all employees


20
Elimination of waste and adding customer value
Must be supported by management but pushed from the bottom up
Total commitment to elimination of waste
Waste-free operations are freed to focus on customer's success
Becomes easier and easier as waste is managed at time of creation
Also simplified by continuously improving process that produce waste


21
Production perspective
Lean production
cuts cost
reduces inventory
frees cash
Supports growth
improving productivity
reduce lead times
May free-up resources
Frees up floor space for additional production or maneuverability
22
Maintenance perspective
Easier identification of problems or non-standard conditions, fix before it becomes a bigger more costly issue
More frequent cleaning improves
Lifetime of equipment
Mean time to failure increased
Production more involved in cleaning and inspection of equipment, jigs, and fixtures

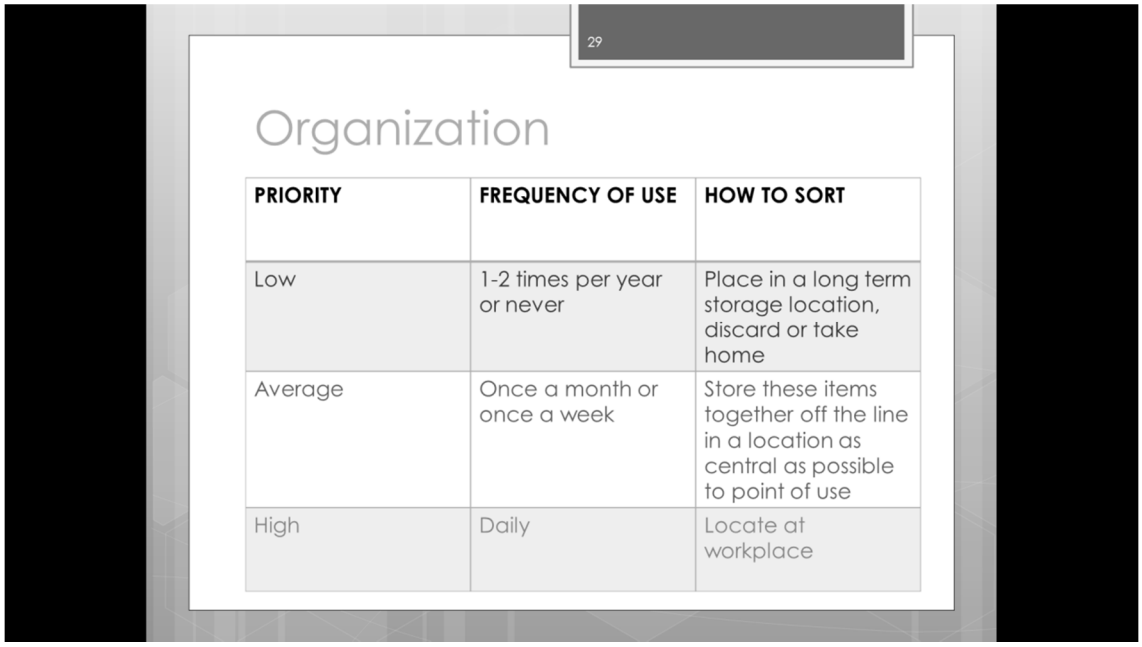

24
SORT


25
Sorting the work place
First time through sort all parts in a space into three baskets, shelves, or tag colors
Used all the time and in working order- green
Used some time - yellow
Never used/not needed or broken – red
Keep only green items in work area
Tools used for the job daily
Jigs and fixtures used daily
Production parts


26
Sorting the work place
Be honest and decided what and how much
When in doubt red tag it
Unneeded items in your workspace?


27
Red tags
Placed on items in an area not needed
Items to be scrapped or moved to storage
Clearly identifies between needed and not needed items
Should have a specific location for holding red tags during review period
Remain a red tag item no more than a week or some pre-determined time period

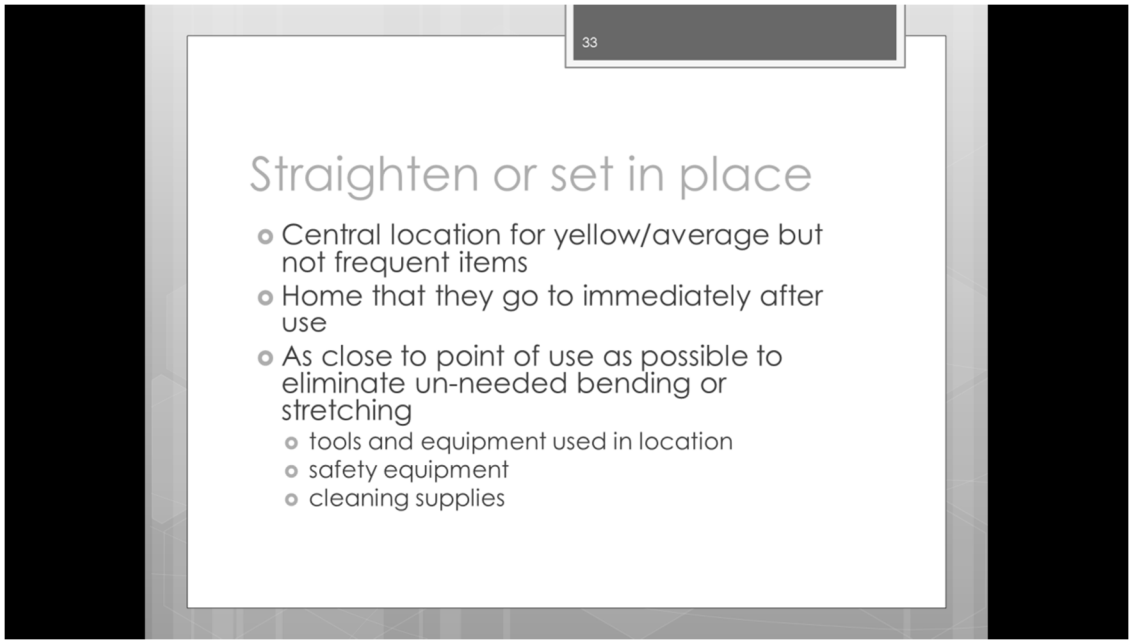

28
5S --- RED TAG
Item Name
&/or Description:
Department:
Value per Item:
Classification:
Raw Material
Work-in-Process
Component
Machine / Equipment
Mold / Jig
Tool / Fitting
Reason:
Finished Product
Unnecessary
Defective
Other
Unknown
Other
Action:
Leftover Material
Eliminate
Return
Move to Red Tag Storage
Completed:
Tag Attached:
Year Month Day
Year Month Day
5S
24

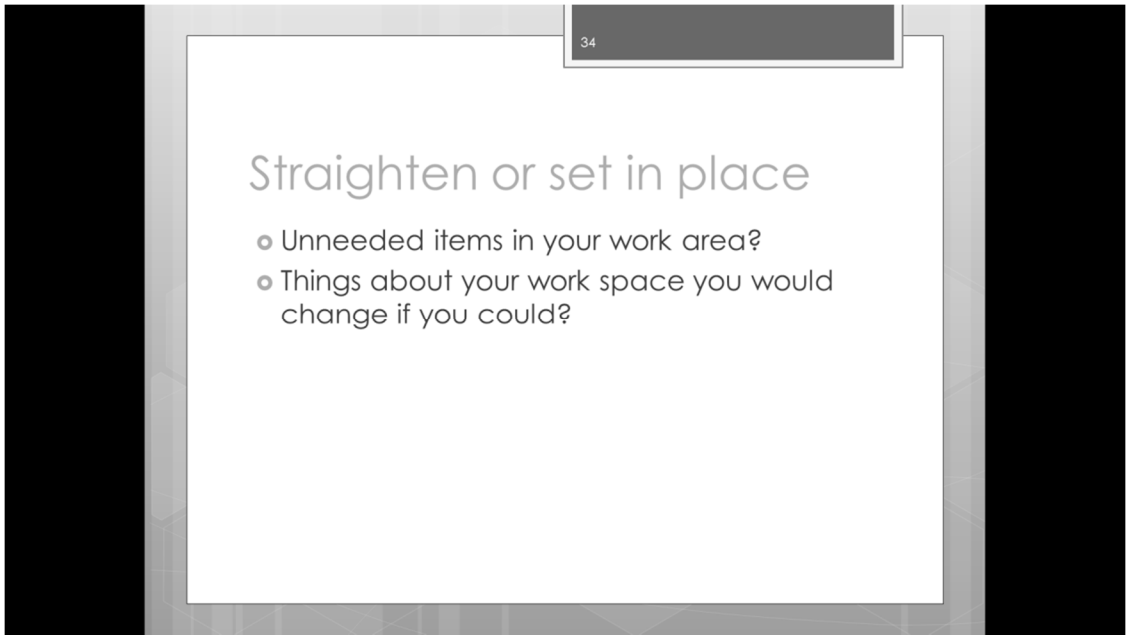

29
Organization
PRIORITY
FREQUENCY OF USE
HOW TO SORT
Low
1-2 times per year or never
Place in a long term storage location, discard or take home
Average
Once a month or once a week
Store these items together off the line in a location as central as possible to point of use
High
Daily
Locate at workplace

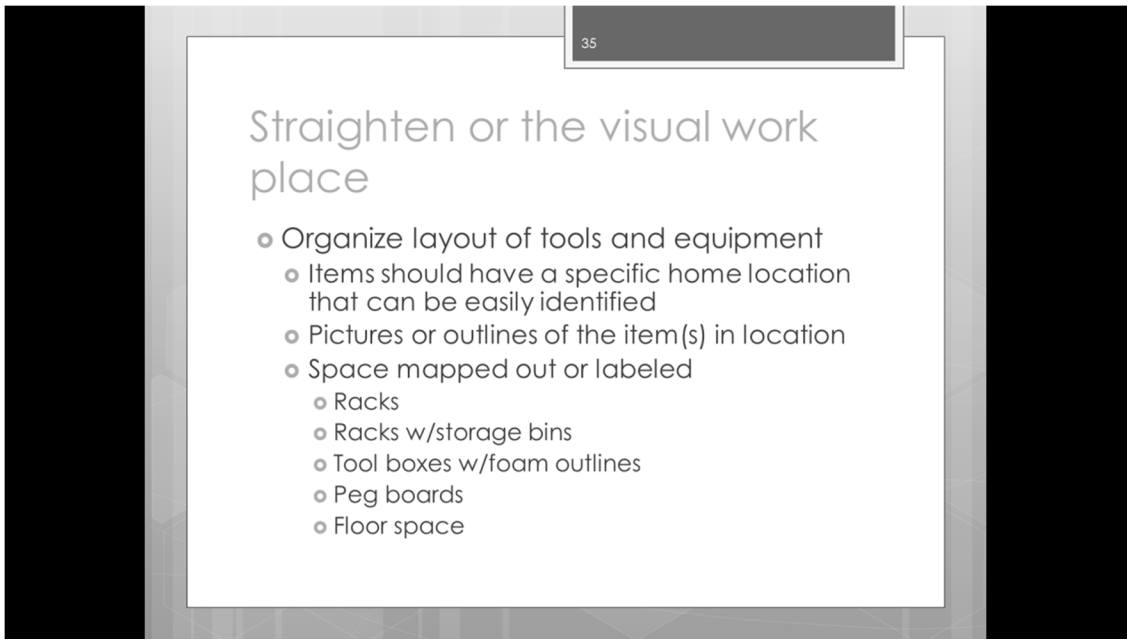

30
Sort advantages
Factory becomes less crowded
Storage locations store only needed Items
Parts and tools located at point of use
No unneeded items and equipment make it easier to see how to improve processes
Only needed stock on hand is kept


31
STRAIGHTEN
SET IN PLACE
OR
THE VISUAL WORK PLACE


32
Straighten or set in place
"A place for everything **needed** and everything in its place"
Done only after there is no question about use level of all items
No red tags must remain
Easily identifiable home
As near as possible to point of use for green/daily use items


33
Straighten or set in place
Central location for yellow/average but not frequent items
Home that they go to immediately after use
As close to point of use as possible to eliminate un-needed bending or stretching
tools and equipment used in location
safety equipment
cleaning supplies


34
Straighten or set in place
Unneeded items in your work area?
Things about your work space you would change if you could?


35
Straighten or the visual work place
Organize layout of tools and equipment
Items should have a specific home location that can be easily identified
Pictures or outlines of the item(s) in location
Space mapped out or labeled
Racks
Racks w/storage bins
Tool boxes w/foam outlines
Peg boards
Floor space


36
Before
After
5S
37

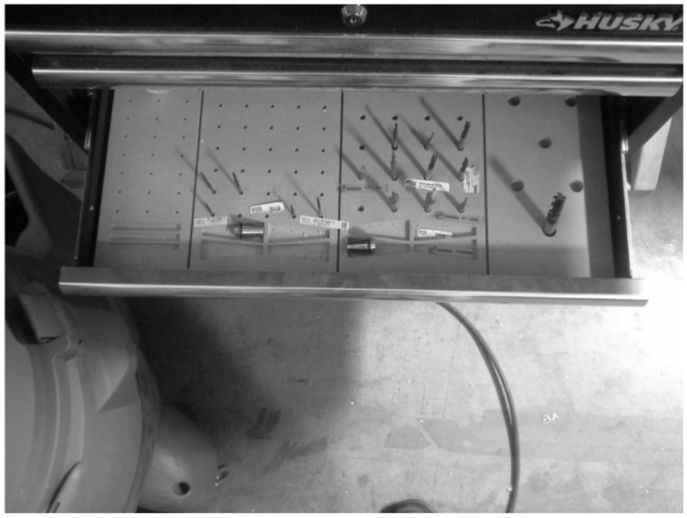

37

38

39

40

41



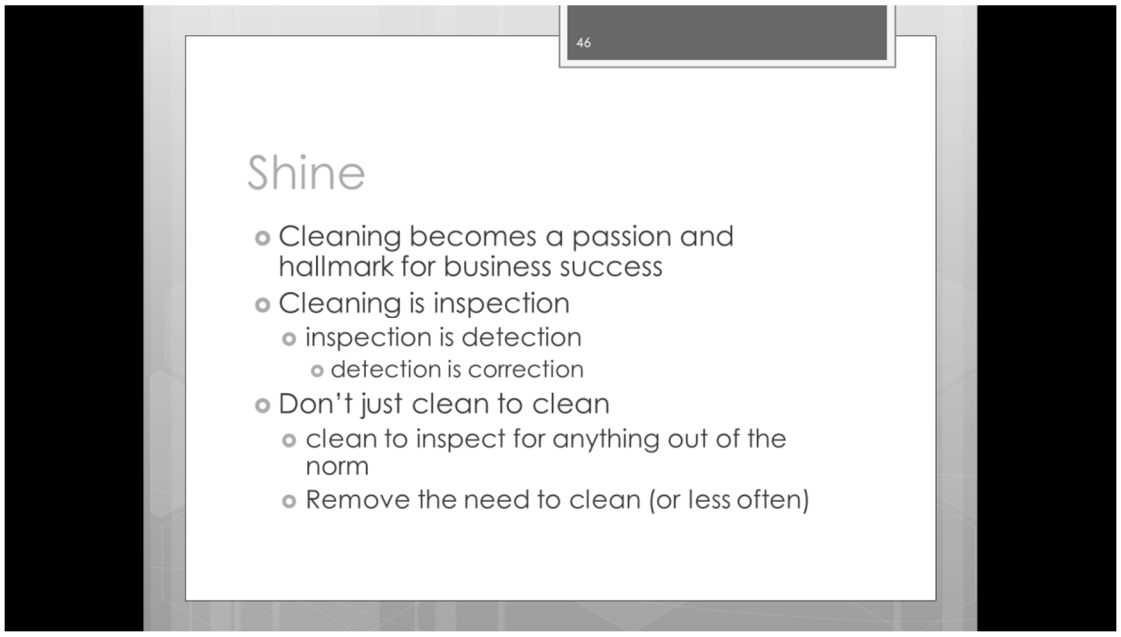
42

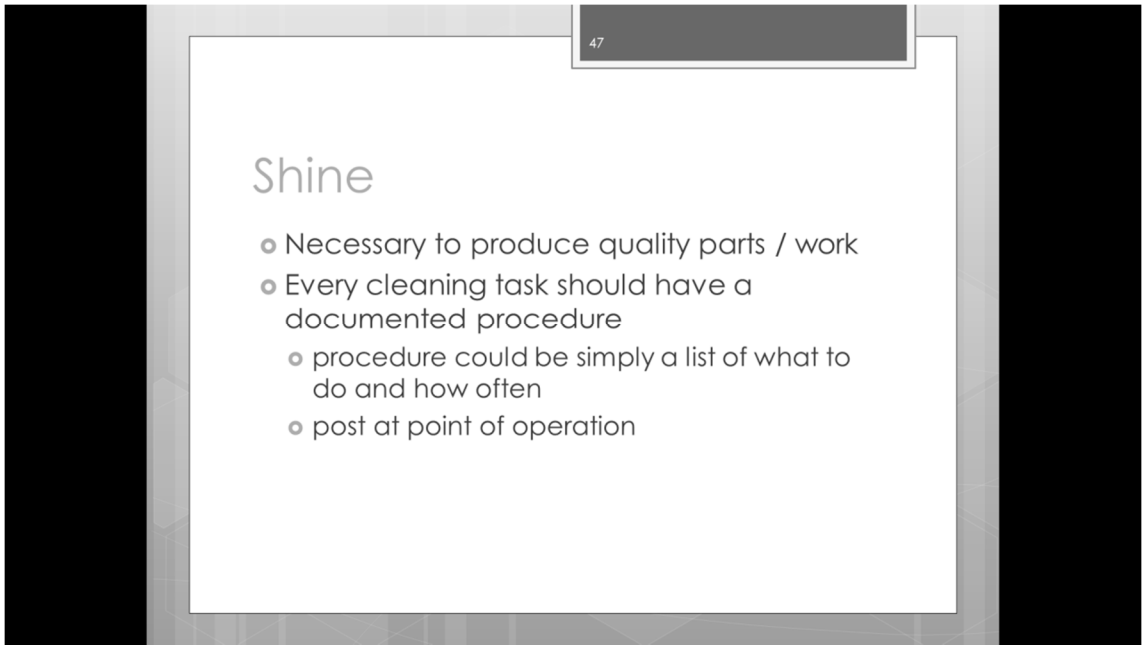
44

Straighten advantages

- No wasted motions
- Resolves frustrations of searching for items
- No unneeded inventory
- Work place made more safe to work in


45
SHINE


46
Shine
Cleaning becomes a passion and hallmark for business success
Cleaning is inspection
inspection is detection
detection is correction
Don't just clean to clean
clean to inspect for anything out of the norm
Remove the need to clean (or less often)

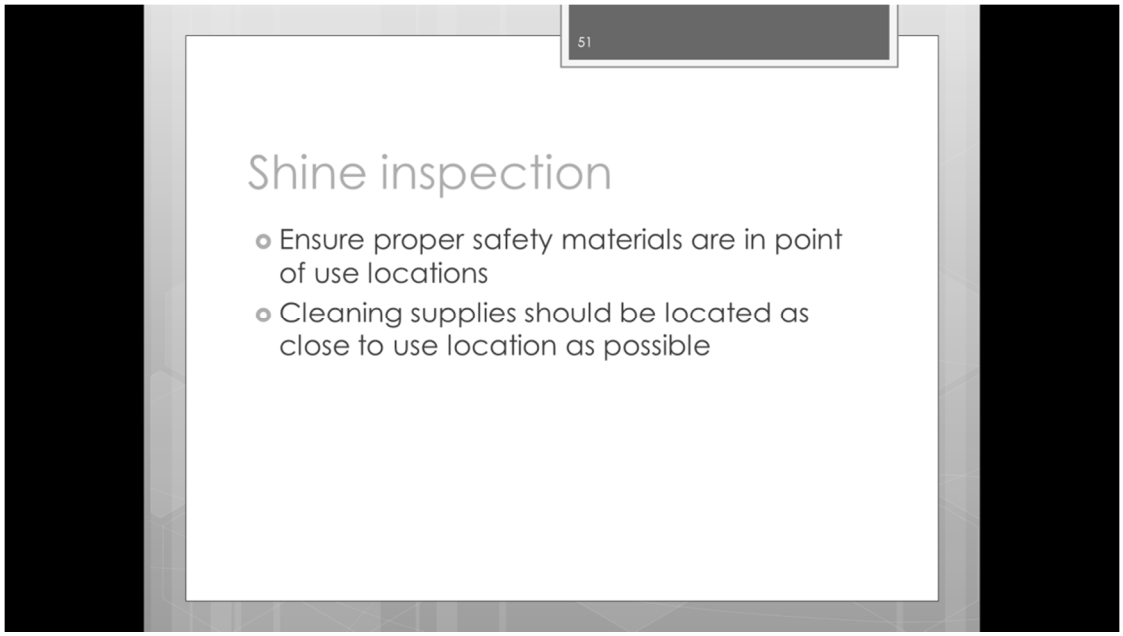

47
Shine
Necessary to produce quality parts / work
Every cleaning task should have a documented procedure
procedure could be simply a list of what to do and how often
post at point of operation


48
Shine inspection
Equipment PM's
Tool and location PM's
Warehouse
Shelves
Isles/floors
Windows
Office spaces


49
Shine inspection
Like a machine inspect for:
Faulty tools/parts
Broken or nonfunctional
Gauges
Jigs
Fixtures
Give everyone area of shine responsibility


50
Shine inspection
Other checkpoints
isles and storage points clearly marked and labeled
tools classified and stored by frequency of use
pallets stacked properly or discarded when not needed
floors in good condition


51
Shine inspection
Ensure proper safety materials are in point of use locations
Cleaning supplies should be located as close to use location as possible


51
Shine inspection
Ensure proper safety materials are in point of use locations
Cleaning supplies should be located as close to use location as possible

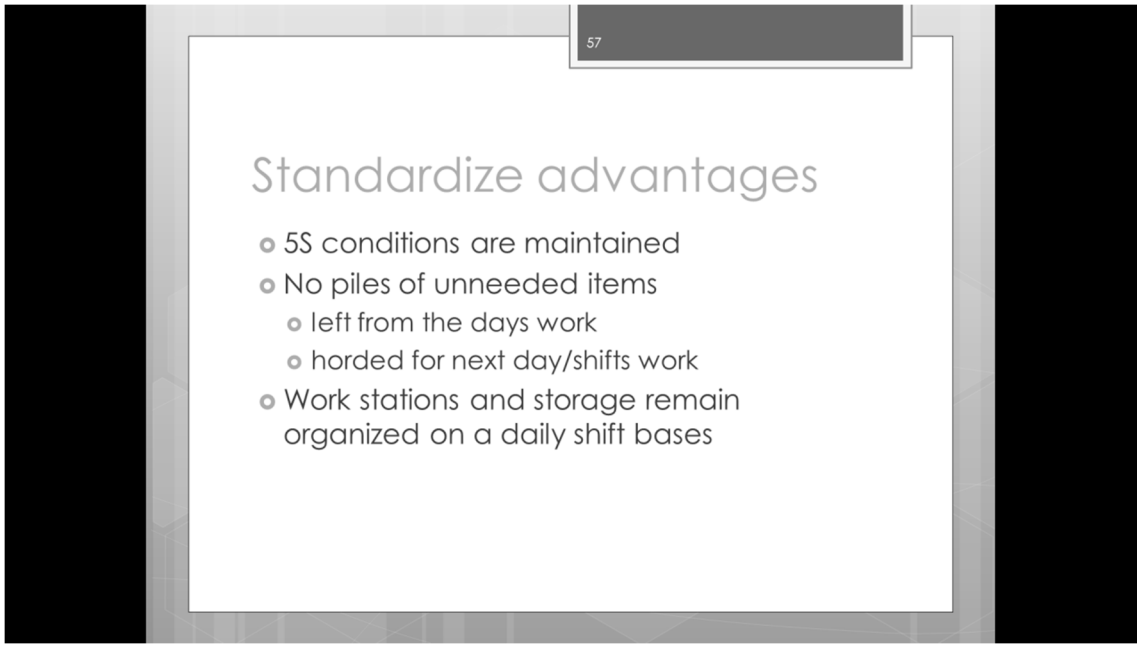

52
Shine advantages
Improves moral
Defects are easier to see
Improves safety
Machines receive more attention


53
STANDARDIZE

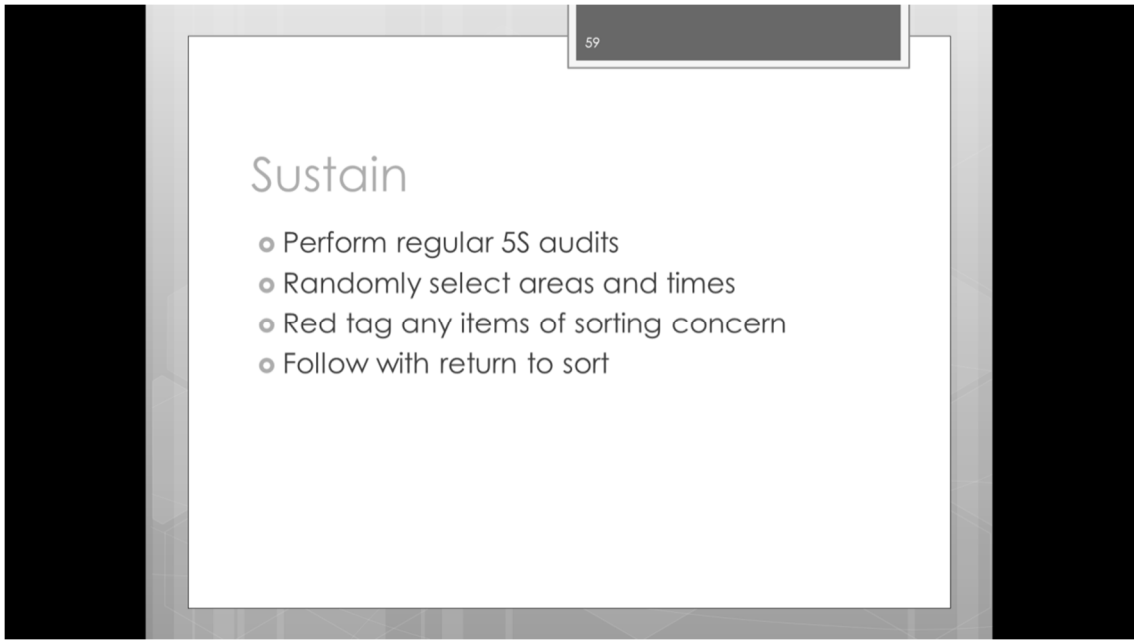

54
Standardize
Implement best practices throughout the work place
Document best practices
Locate documents at work place
Without standardization everyone has their own rules leading to disorganization and chaos

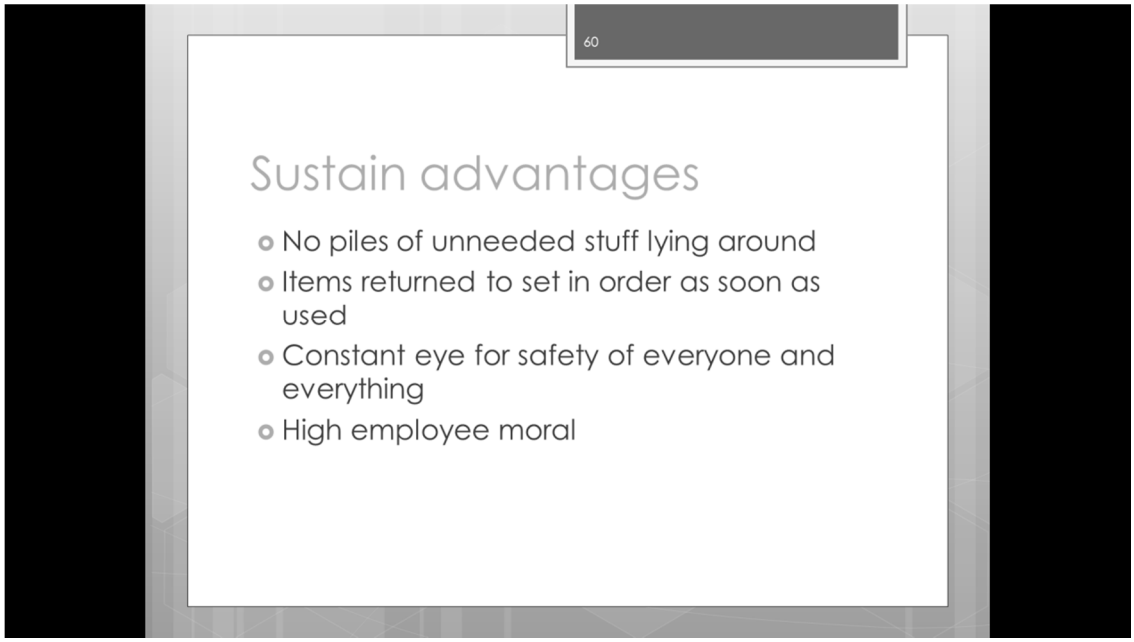

55
What to standardize
Tools that belong in an area
How often to remove scrap or empty bins
When and how to perform red tagging
Location of tools and equipment not used at a specific location frequently

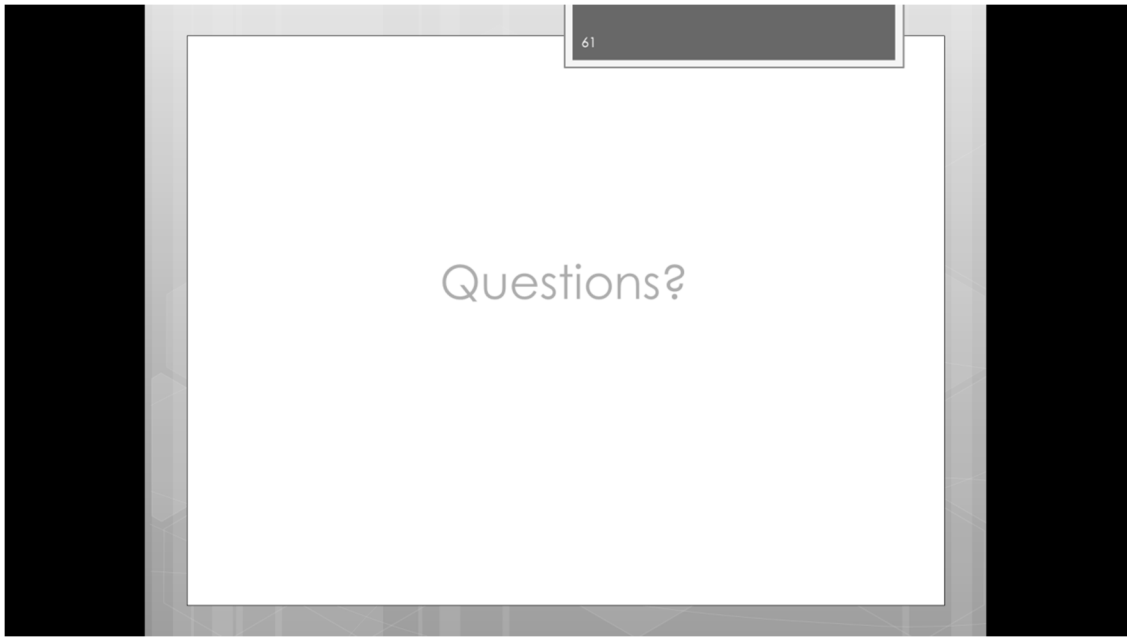

56
What to standardize
Storage for hazardous items
How often to clean
Best practices for cleaning and organizing
How often to perform 5S review
Protective clothing as needed should be included
Standardize so that anyone in the plant can easily do a 5S as review on any area


57
Standardize advantages
5S conditions are maintained
No piles of unneeded items
left from the days work
horded for next day/shifts work
Work stations and storage remain organized on a daily shift bases


58
SUSTAIN


59
Sustain
Perform regular 5S audits
Randomly select areas and times
Red tag any items of sorting concern
Follow with return to sort


60
Sustain advantages
No piles of unneeded stuff lying around
Items returned to set in order as soon as used
Constant eye for safety of everyone and everything
High employee moral


61
Questions?


69
Costs
Possible Organization materials
Pegboards
Tool box foam
Red tags
Durable vinyl tape for marking locations


70
Project cost examples
www.the5sstore.com
www.5sleanmanufacturing.com
www.azardisplays.com
www.grainger.com
www.mcmaster.com

Appendix M: Data Collection for Company A

5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	1	**DATE:**	18-Mar-15
Last Audit Score:		**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	3	18	11	8	0	**40**
# of Questions	6	11	10	8	4	**39**
Average Score	**0.5**	**1.6**	**1.1**	**1.0**	**0.0**	**1.0**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**0**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**0**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**1**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**0**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**0**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**

9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**0**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**3**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**2**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**4**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**3**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**0**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**0**

SCORING GUIDELINES

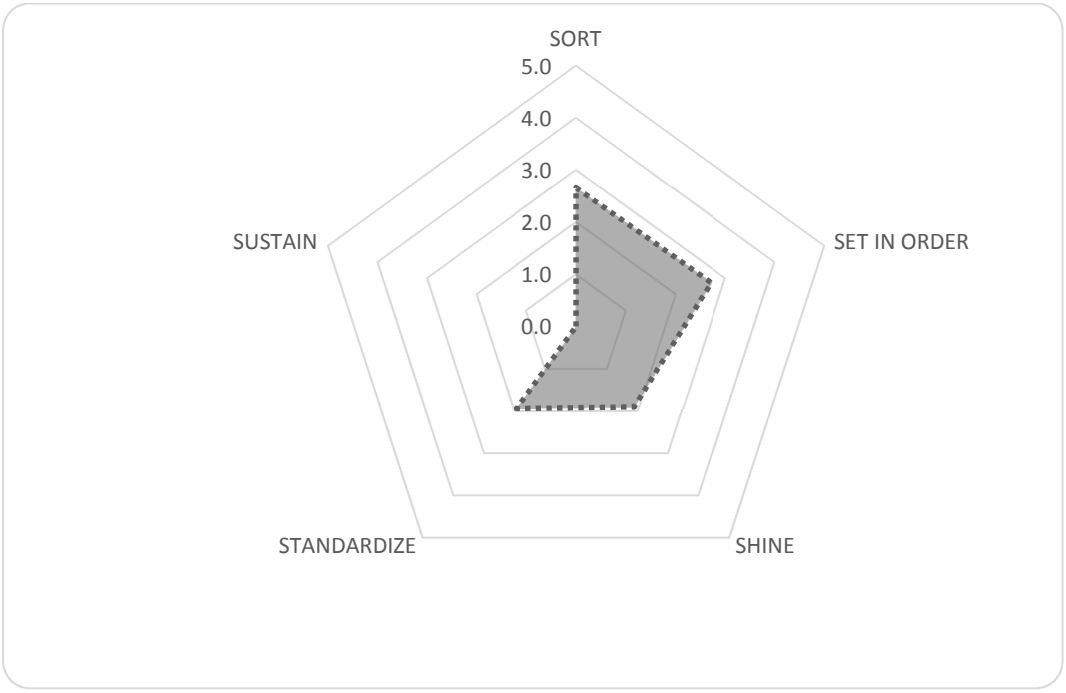
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**0**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**1**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**0**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**0**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**0**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**2**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**0**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**0**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**0**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**0**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**0**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**0**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.

4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	2	**DATE:**	3-Apr-15
Last Audit Score:	1	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	3	18	16	8	0	**45**
# of Questions	6	11	10	8	4	**39**
Average Score	**0.5**	**1.6**	**1.6**	**1.0**	**0.0**	**1.2**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**0**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**0**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**1**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**0**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**0**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**0**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**3**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**2**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**4**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**3**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**0**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**0**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

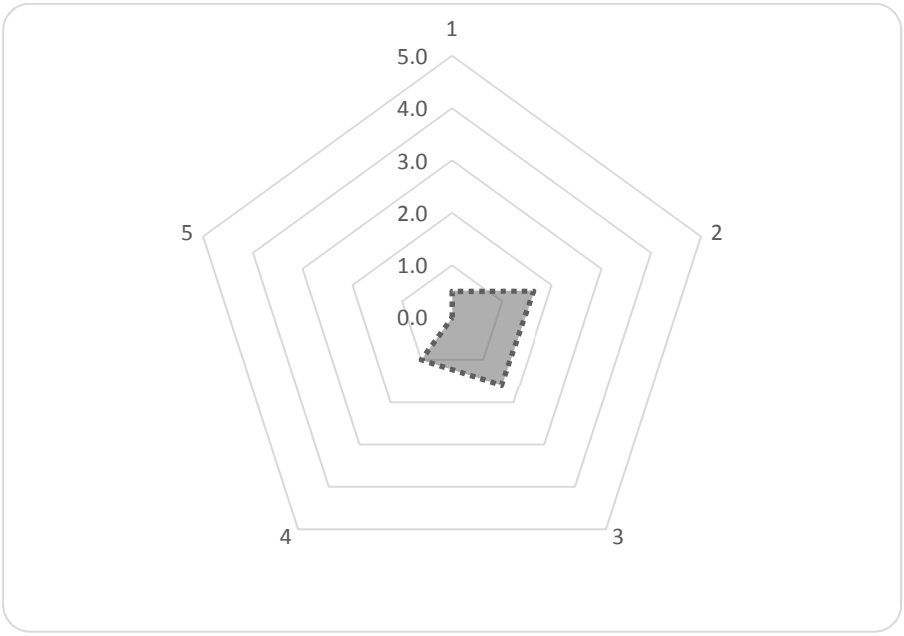
SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**0**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**1**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**0**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**0**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**2**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**0**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**0**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**0**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**0**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**0**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**0**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.

Notes: Company has started a major remodel and organization of manufacturing floorwhich has taken some steps backwards in 5S.



5S AUDIT CHECKLIST

AREA:	Company A	Audit #	3	DATE:	16-Apr-15
Last Audit Score:	1.2	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	8	19	19	12	9	**67**
# of Questions	6	11	10	6	4	**37**
Average Score	**1.3**	**1.7**	**1.9**	**2.0**	**2.3**	**1.8**

SCORING GUIDELINES

0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**1**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**0**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**1**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**0**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**2**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**2**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**2**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**1**

SCORING GUIDELINES

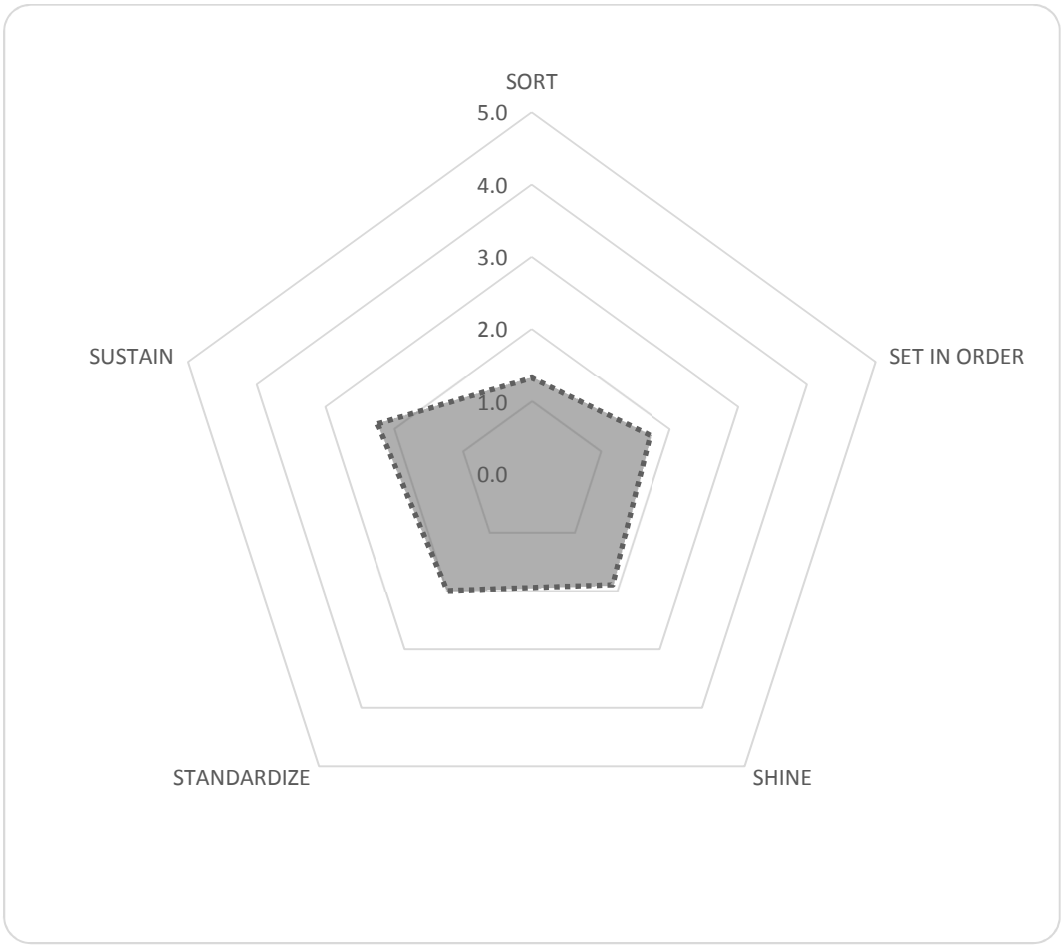
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**0**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**2**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**1**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**1**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**2**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**2**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**2**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**2**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.

3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



AREA:	Company A	Audit #	4	DATE:	30-Apr-15
Last Audit Score:	1.8	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	11	30	25	15	11	**92**
# of Questions	6	11	10	6	4	**37**
Average Score	**1.8**	**2.7**	**2.5**	**2.5**	**2.8**	**2.5**

SCORING GUIDELINES

0 ZERO EFFORT	1 SLIGHT EFFORT	2 MODERATE EFFORT	3 MINIMUM ACCEPTABLE LEVEL	3.5 (4) ABOVE AVERAGE RESULTS	4.5 (5) OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**2**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**1**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**1**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**1**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**3**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**1**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**1**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**1**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**2**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**2**

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0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
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4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

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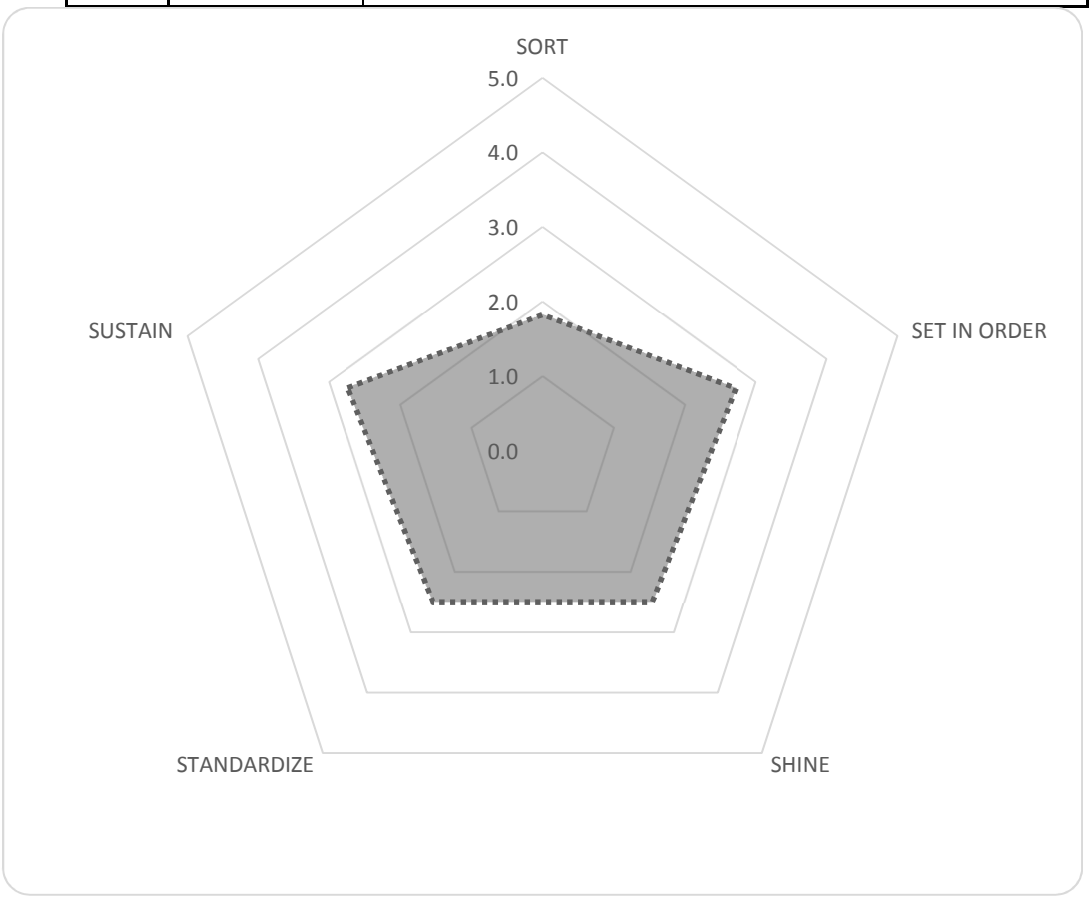


AREA:	Company A	Audit #	5	DATE:	6-May-15
Last Audit Score:	2.5	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	14	32	25	18	10	**99**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.3**	**2.9**	**2.5**	**3.0**	**2.5**	**2.7**

SCORING GUIDELINES

0 ZERO EFFORT	1 SLIGHT EFFORT	2 MODERATE EFFORT	3 MINIMUM ACCEPTABLE LEVEL	3.5 (4) ABOVE AVERAGE RESULTS	4.5 (5) OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**2**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**2**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**1**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

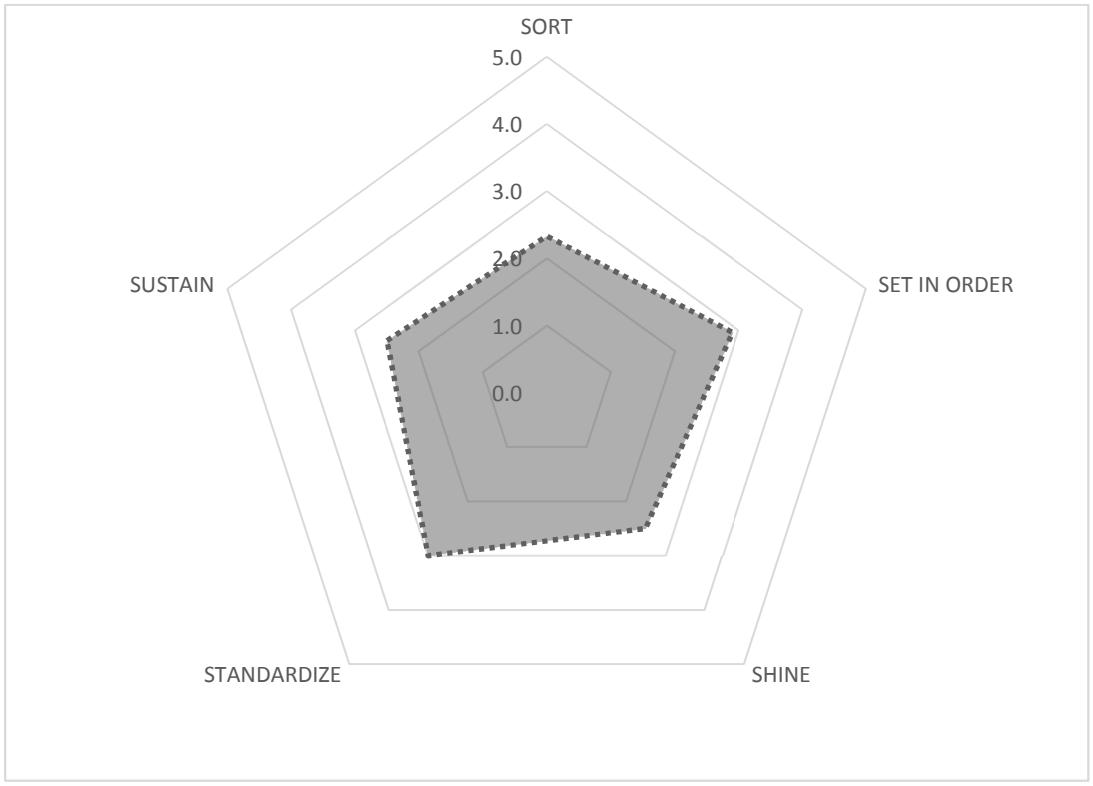
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**2**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**1**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**1**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**1**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is work+B31ing on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	6	**DATE:**	20-May-15
Last Audit Score:	2.7	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	14	33	27	19	9	**102**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.3**	**3.0**	**2.7**	**3.2**	**2.3**	**2.8**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**2**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**1**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

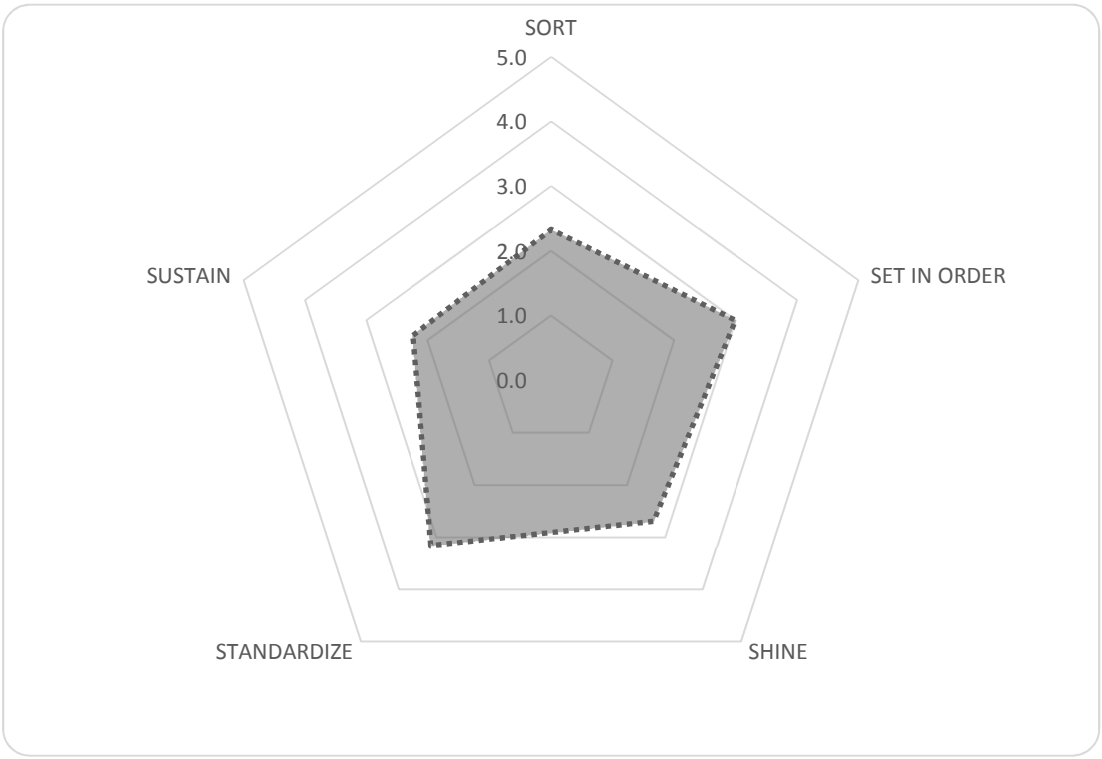
0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	SCORE
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	7	**DATE:**	5-Jun-15
Last Audit Score:	2.8	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	14	33	27	19	9	**102**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.3**	**3.0**	**2.7**	**3.2**	**2.3**	**2.8**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**2**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**1**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**2**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

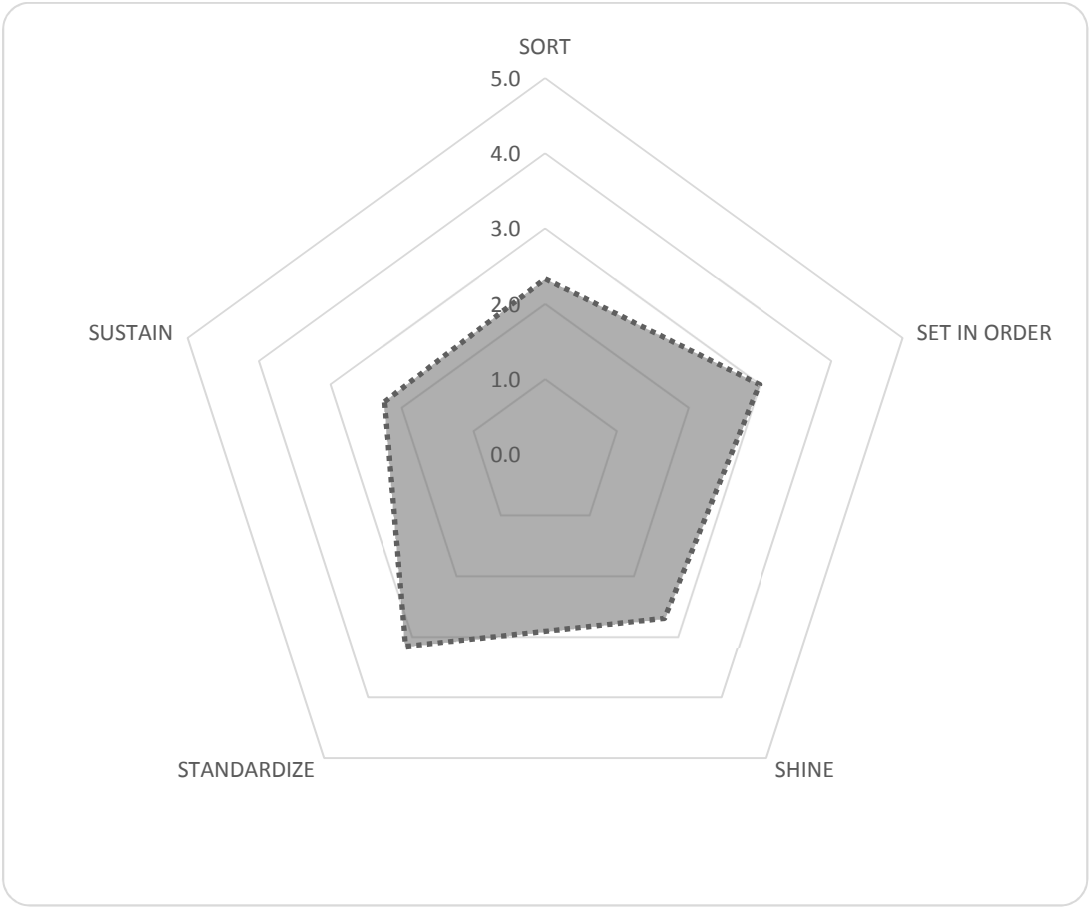
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	8	**DATE:**	16-Jun-15
Last Audit Score:	2.8	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	16	35	\	19	9	**79**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.7**	**3.2**	**#VALUE!**	**3.2**	**2.3**	**2.1**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**3**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**2**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**3**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
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22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
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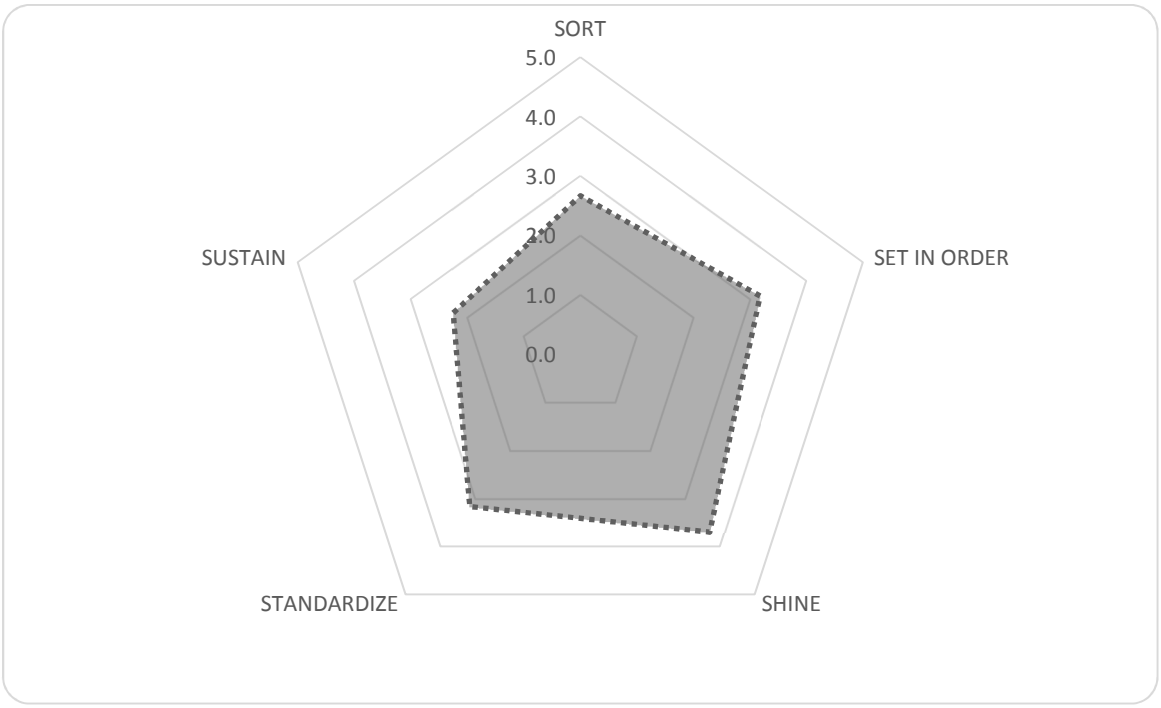


5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	9	**DATE:**	1-Jul-15
Last Audit Score:	2.1	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	16	35	27	19	9	**106**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.7**	**3.2**	**2.7**	**3.2**	**2.3**	**2.9**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**3**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**2**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**3**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

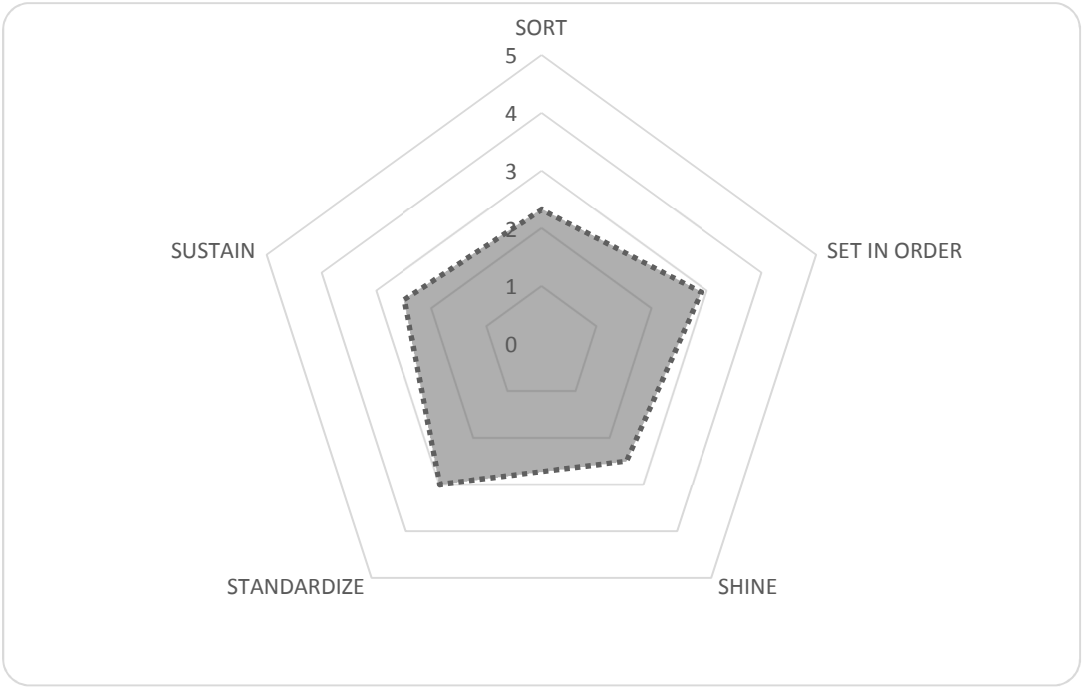
0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.

4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	10	**DATE:**	10-Jul-15
Last Audit Score:	2.9	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	17	37	27	19	11	**111**
# of Questions	6	11	10	6	4	**37**
Average Score	**2.8**	**3.4**	**2.7**	**3.2**	**2.8**	**3.0**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**3**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**2**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**3**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**2**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**2**

SCORING GUIDELINES

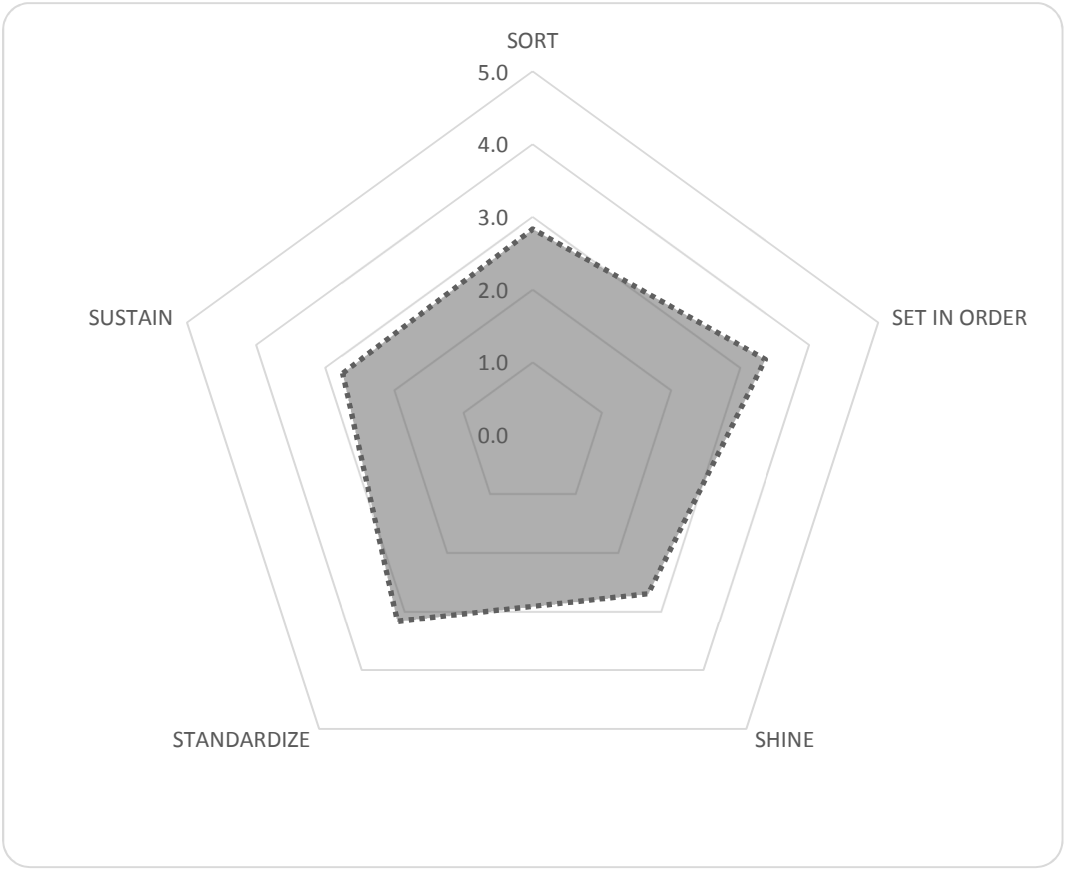
0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**1**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**1**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**4**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**2**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.

4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	11	**DATE:**	31-Jul-15
Last Audit Score:	3	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	28	47	37	25	9	**146**
# of Questions	6	11	10	6	4	**37**
Average Score	**4.7**	**4.3**	**3.7**	**4.2**	**2.3**	**3.9**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**5**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**5**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**4**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**4**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**5**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**4**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**2**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**2**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**3**

STANDARDIZE ACTIVITY DESCRIPTIONS		SCORE
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**3**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**3**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
SUSTAIN ACTIVITY DESCRIPTIONS		**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
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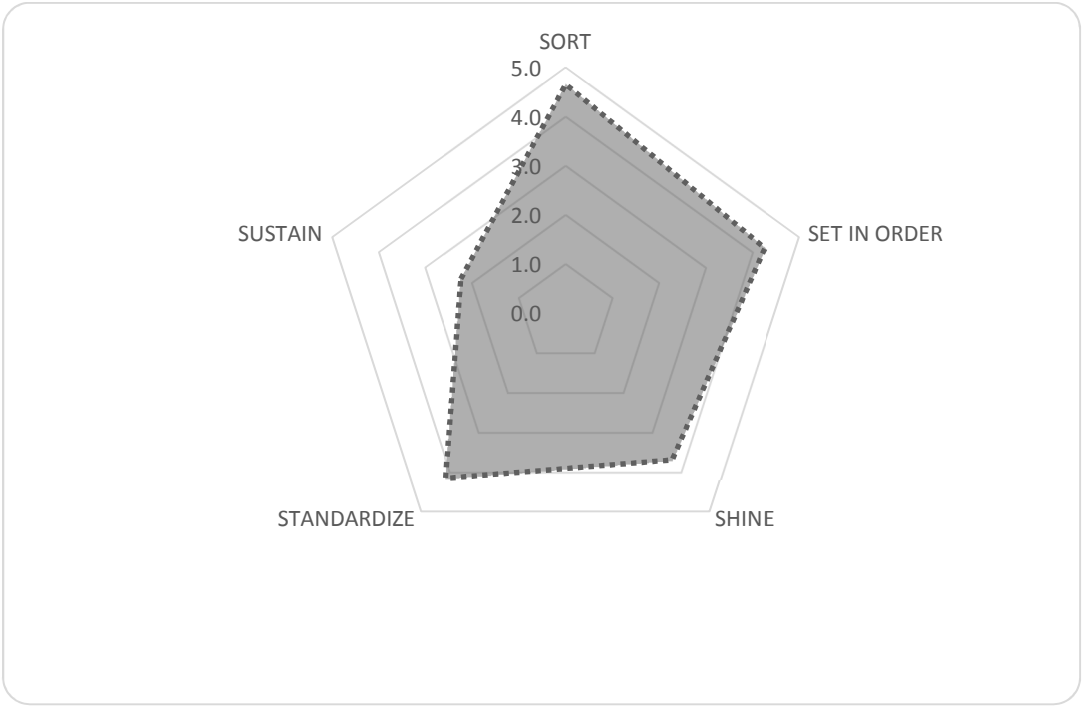
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.A58
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company A	**Audit #**	12	**DATE:**	**20-Aug-15**
Last Audit Score:	4.4	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	26	50.5	45	31	20	**172.5**
# of Questions	6	11	10	6	4	**37**
Average Score	**4.3**	**4.6**	**4.5**	**5.2**	**5.0**	**4.7**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**3**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**5**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4.5**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4.5**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**4**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**4**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**4**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**5**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4.5**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**5**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
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21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**4**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**4**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**5**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**4**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**4**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**4**
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32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**5**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**5**

SCORE	CATEGORY	DESCRIPTION
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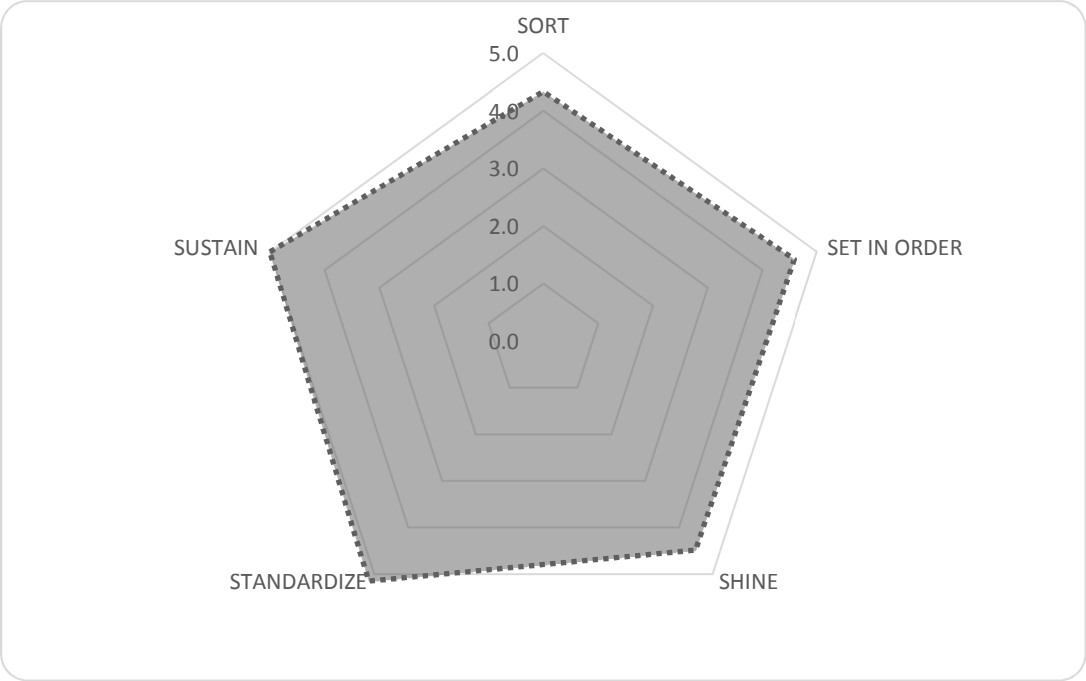
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



Company A Changeover/Setup Data

Die change from and to	Time in minutes and seconds	
	Pre 5S changeover/setup time	Post 5S changeover/setup time
Machine 1		
12 to 20	26:19.0	20:01.0
20 to 2	24:00.0	21:16.0
2 to 154	31:01.0	22:21.0
154 to 6	27:23.0	21:01.0
6 to 22	27:12.0	23:00.0
22 to 21	25:09.0	20:44.0
21 to 30	25:12.0	19:45.0
30 to 15	22:23.0	19:22.0
15 to 25	21:12.0	19:23.0
25 to 130	28:23.0	23:00.0
130 to 156	24:43.0	20:12.0
156 to 33	30:22.0	20:45.0
Machine 2		
24 to 13	24:01.0	22:00.0
13 to 120	25:14.0	23:23.0
120 to 14	27:19.0	25:59.0
14 to 100	24:32.0	20:00.0
100 to 43	26:00.0	21:01.0
43 to 23	25:15.0	23:23.0
Die 23 to 24	20:59.0	17:59.0
		21:57.9
Machine 3		
155 to 174	23:43.0	18:34.0
174 to 77	23:15.0	19:20.0
77 to 93	20:12.0	19:45.0
93 to 99	24:05.0	17:23.0
99 to 153	22:32.0	18:21.0
153 to 194	21:09.0	18:12.0
194 to 167	22:10.0	19:00.0
167 to 187	25:12.0	18:31.0
187 to 116	23:23.0	19:01.0

116 to 197	23:23.0	19:45.0
197 to 175	25:19.0	18:23.0
175 to 192	20:12.0	19:45.0
192 to 76	26:17.0	20:00.0
76 to 196	25:17.0	22:12.0
196 to 195	28:16.0	22:01.0
195 to 179	24:12.0	18:21.0

Machine 4

200 to 198	24:23.0	20:00.0
75 to 70	25:12.0	20:01.0
70 to 200	26:14.0	21:43.0
200 to 165	25:12.0	21:53.0
165 to 186	24:56.0	19:59.0
186 to 180	22:21.0	18:45.0
185 to 173	24:00.0	19:23.0
173 to 122	25:17.0	20:02.0
122 to 152	25:54.0	21:14.0
152 to 188	25:59.0	19:51.0
188 to 75	26:18.0	20:59.0
75 to 69	27:45.0	21:01.0

Machine 5

60 to 68	27:00.0	24:19.0
68 to 70	26:10.0	23:01.0
70 to 108	28:09.0	25:34.0
108 to 181	30:21.0	26:34.0
181 to 131	30:03.0	24:45.0
131 to 157	28:00.0	24:31.0
157 to 84	30:00.0	25:22.0
84 to 129	32:23.0	26:35.0
129 to 95	28:59.0	24:00.0
95 to 90	26:45.0	23:59.0
90 to 78	28:01.0	23:49.0

Machine 6		
79 to 87	30:12.0	25:23.0
87 to 150	32:01.0	27:24.0
150 to 99	31:34.0	26:01.0
99 to 128	32:32.0	25:32.0
Machine 7		
79 to 143	32:23.0	26:01.0
143 to 112	34:09.0	28:23.0
112 to 83	35:01.0	28:56.0
83 to 67	36:12.0	29:45.0
67 to 147	33:34.0	26:43.0

Appendix N**:** Data Collection for Company B

5S AUDIT CHECKLIST

AREA:	Company B	**Audit #**	1	**DATE:**	18-Mar-15
Last Audit Score:		**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	16	28	19	15.5	0	**80.5**
# of Questions	6	11	10	8	4	**39**
Average Score	**2.7**	**2.5**	**1.9**	**1.9**	**0.0**	**2.1**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**1**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**4**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**3**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**4**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**3**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**3**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**0**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**4**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**3**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**5**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**0**

SCORING GUIDELINES

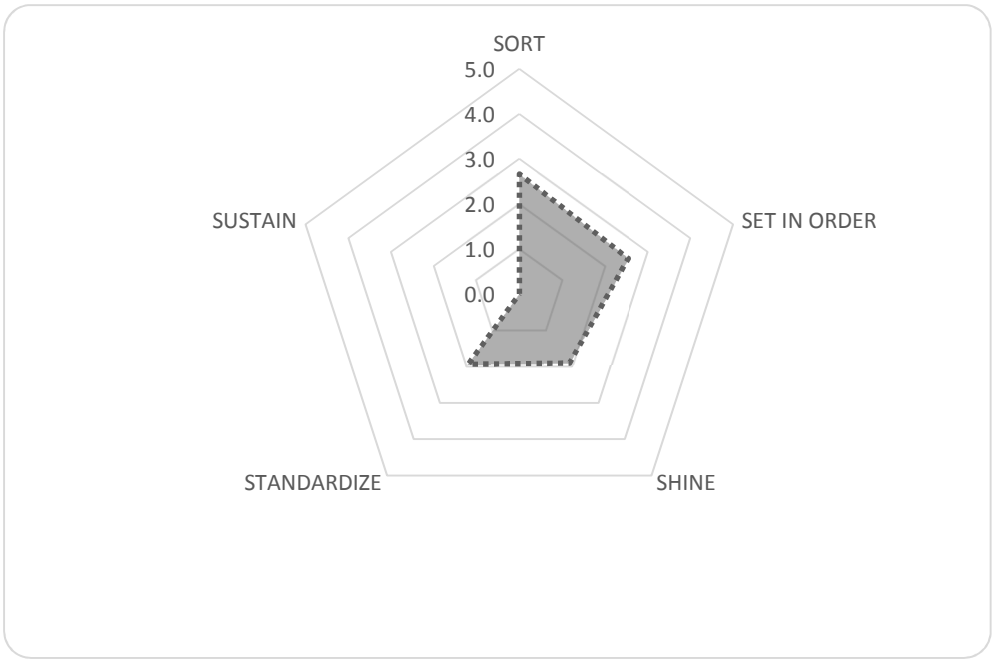
0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**2**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**3**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**1**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**0**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**0**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**3**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**4**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3.5**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**0**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**0**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**0**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.

4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company B	**Audit #**	2	**DATE:**	3-Apr-15
Last Audit Score:	2.1	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	23	43	19	15.5	16	**116.5**
# of Questions	6	11	10	8	4	**39**
Average Score	**3.8**	**3.9**	**1.9**	**1.9**	**4.0**	**3.0**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**4**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**3**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**3**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**4**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**5**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**0**

SCORING GUIDELINES

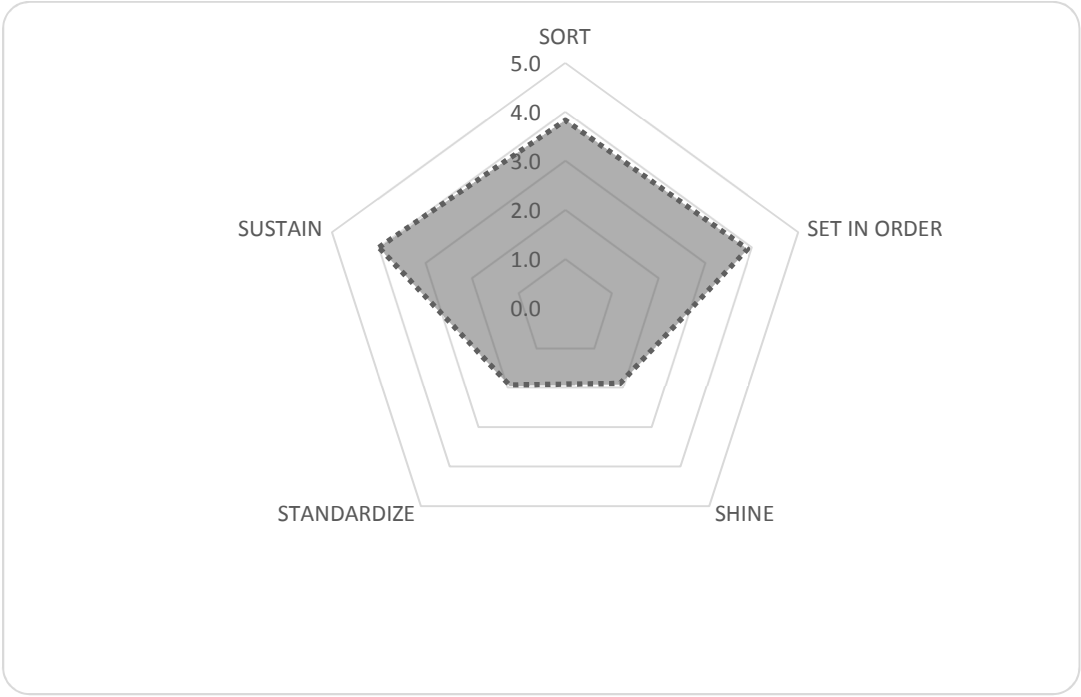
0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**2**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**3**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**1**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**0**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**0**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**3**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**4**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**2**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3.5**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**0**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**1**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**5**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.

4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company B	**Audit #**	3	**DATE:**	16-Apr-15
Last Audit Score:	3	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	28	44.5	39	31	8	**150.5**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.7**	**4.0**	**3.9**	**3.9**	**2.0**	**3.9**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**4**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**5**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4.5**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**4**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**3**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**5**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**0**

SCORING GUIDELINES

0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
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21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**3**

27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**4.5**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3.5**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**2**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**3**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**3**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**2**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**1**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
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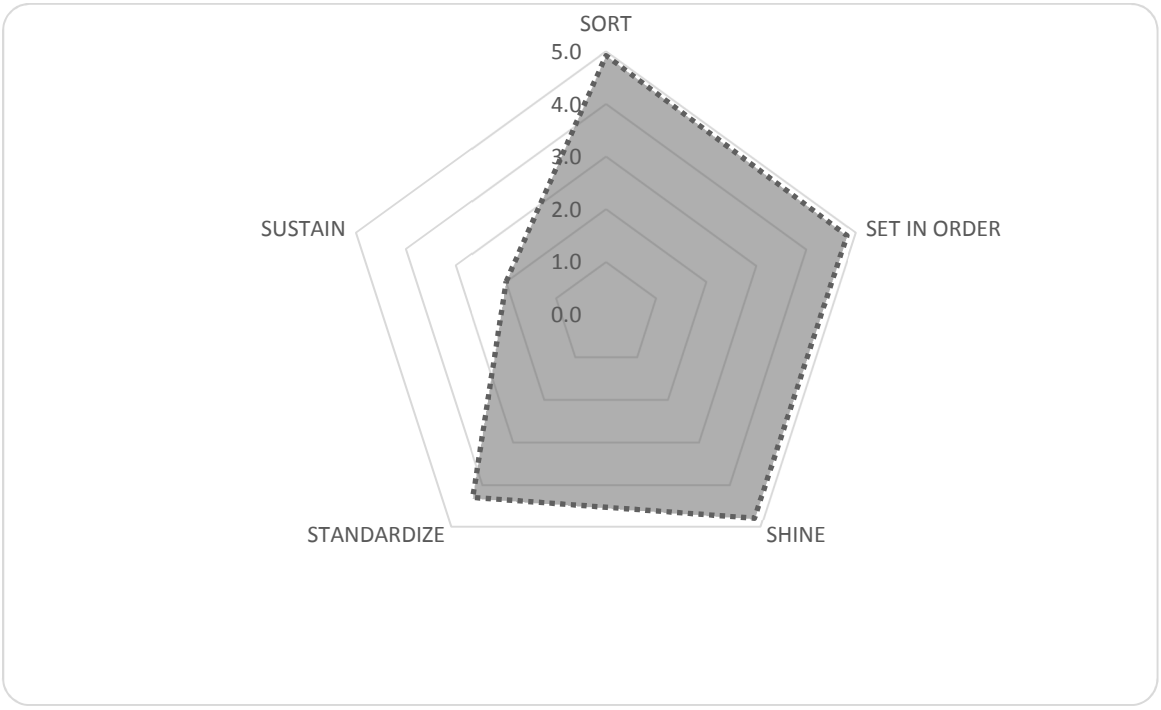


5S AUDIT CHECKLIST

AREA:	Company B	Audit #	4	DATE:	30-Apr-15
Last Audit Score:	3.9	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUST AIN	TOTAL
Total Score	29.5	51.5	46	37.5	14	**178.5**
# of Questions	6	11	10	6	4	**37**
Average Score	**4.9**	**4.7**	**4.6**	**6.3**	**3.5**	**4.8**

SCORING GUIDELINES

0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**5**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4.5**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**5**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4.5**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**4.5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**4**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4.5**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**4**

SCORING GUIDELINES

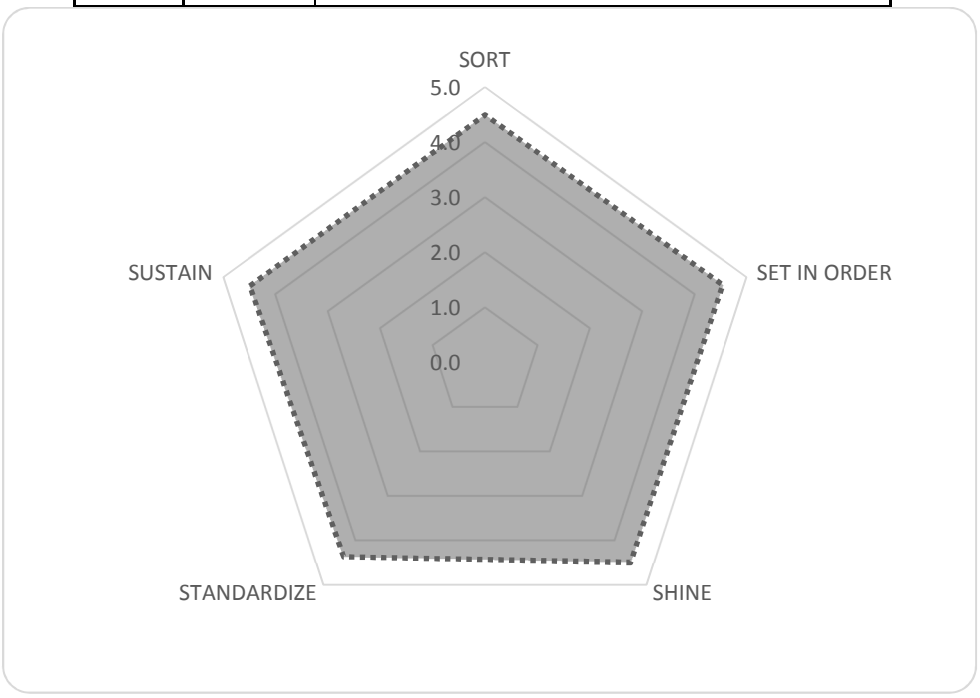
0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4.5**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**4**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**4.5**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**4.5**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**4.5**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**4.5**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**5**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4.5**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**4.5**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**5**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**4**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.

3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



Company B Changeover/Setup Data

Time in minutes and seconds	
Pre 5S	Post 5S
26:01.0	15:01.0
23:00.0	16:32.0
27:23.0	15:32.0
25:32.0	17:23.0
37:00.0	15:12.0
24:34.0	15:32.0
25:45.0	16:21.0
25:32.0	14:59.0
27:18.0	16:01.0
26:32.0	15:35.0
34:01.0	15:43.0
25:53.0	17:23.0
29:43.0	14:23.0
26:32.0	15:23.0
28:23.0	16:12.0
25:34.0	16:01.0
35:01.0	15:23.0
27:23.0	15:15.0
26:43.0	16:32.0
25:09.0	17:21.0
30:23.0	15:23.0
25:23.0	16:21.0
32:01.0	15:23.0
30:24.0	14:28.0
24:59.0	17:25.0
28:45.0	14:32.0
25:00.0	15:23.0
30:54.0	16:32.0
25:09.0	15:24.0
28:14.0	17:32.0
24:23.0	18:01.0
29:12.0	16:43.0
30:23.0	16:23.0
29:05.0	15:49.0

Appendix O: Data Collection for Company C

5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	1	**DATE:**	18-Mar-15
Last Audit Score:		**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	8	9	7	2	0	**26**
# of Questions	6	11	10	6	4	**37**
Average Score	**1.3**	**0.8**	**0.7**	**0.3**	**0.0**	**0.7**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**0**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**0**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**4**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**0**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**0**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**4**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**0**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**0**

9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**0**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**0**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**0**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**0**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**4**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**1**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**0**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**1**

SCORING GUIDELINES

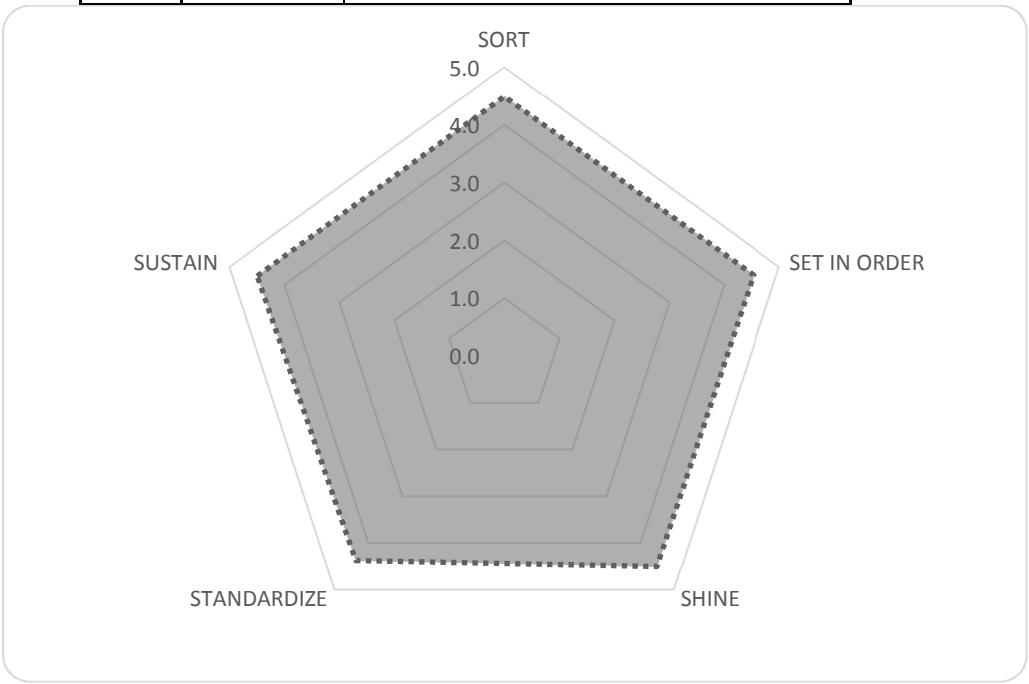
0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SHINE ACTIVITY DESCRIPTIONS	SCORE
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**0**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**0**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**0**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**0**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**0**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**1**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**1**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**0**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**0**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**0**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**2**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**0**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**0**
34)	**Areas for improvement** identified during the previous audit have been completed.	**0**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**0**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**0**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**0**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.

4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	2	**DATE:**	3-Apr-15
Last Audit Score:	0.7	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	17	19	9	18	8	**71**
# of Questions	6	11	10	8	4	**39**
Average Score	**2.8**	**1.7**	**0.9**	**2.3**	**2.0**	**1.8**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**1**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**1**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**0**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**1**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**4**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**0**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**0**

12)	Work areas requiring **personal protective equipment** are clearly labeled.	**0**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**4**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**4**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**0**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

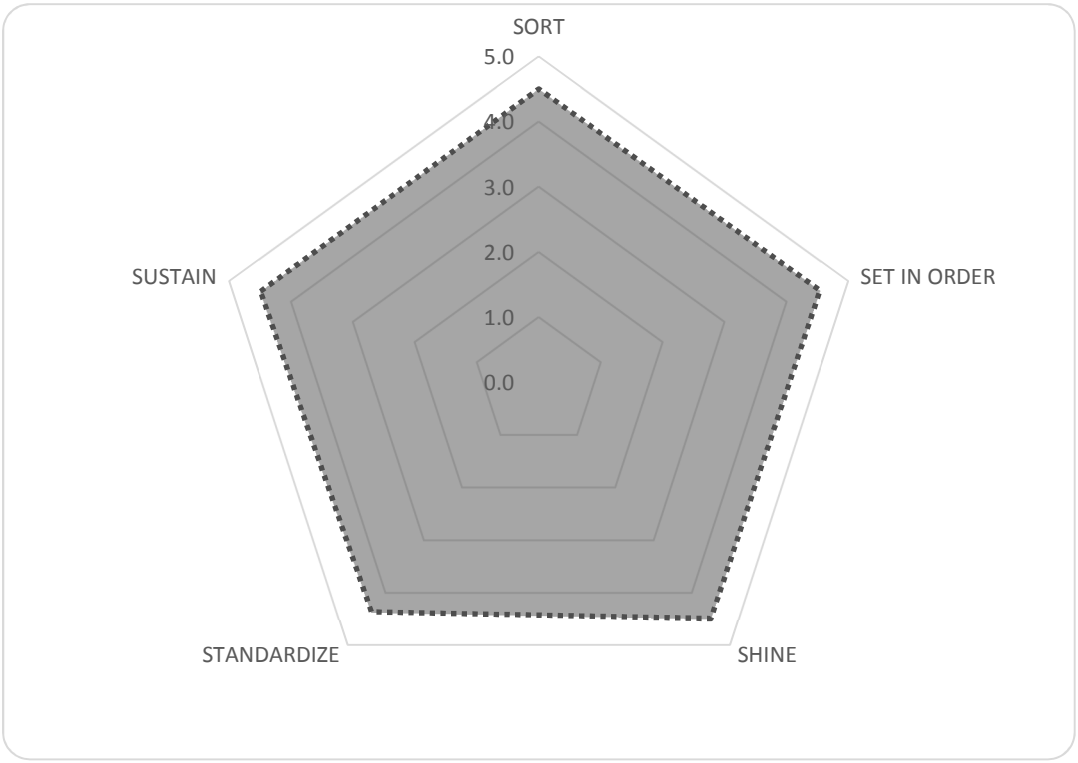
SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**1**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**0**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**0**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**1**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**0**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**0**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**1**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**1**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**0**

29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**2**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**1**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**1**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**1**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**3**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.


SORT
5.0
4.0
3.0
2.0
1.0
0.0
SET IN ORDER
SHINE
STANDARDIZE
SUSTAIN

5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	3	**DATE:**	16-Apr-15
Last Audit Score:	1.8	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	19	38	30	28	10	**125**
# of Questions	6	11	10	8	4	**39**
Average Score	**3.2**	**3.5**	**3.0**	**3.5**	**2.5**	**3.2**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**2**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**2**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**2**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**2**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**1**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

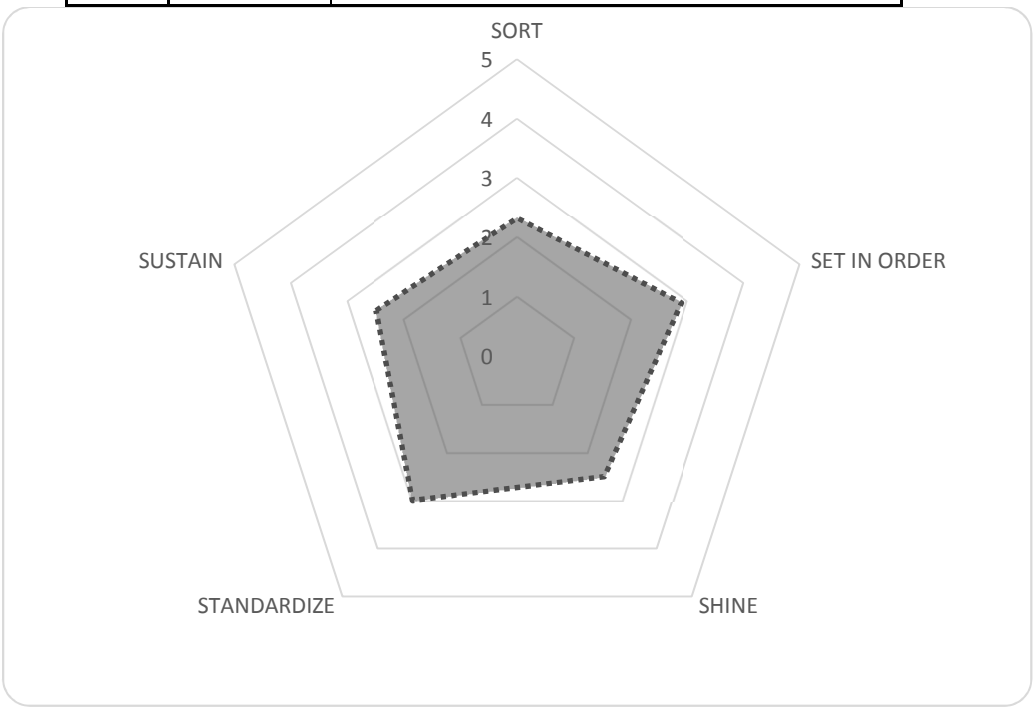
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**2**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**2**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**2**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**2**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**2**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**

28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**1**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**3**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**3**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company C	Audit #	4	DATE:	30-Apr-15
Last Audit Score:	3.2	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	22	40	38	29	10	**139**
# of Questions	6	11	10	8	4	**39**
Average Score	**3.7**	**3.6**	**3.8**	**3.6**	**2.5**	**3.6**

SCORING GUIDELINES

0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**3**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**3**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**2**

8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**2**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**3**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**3**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

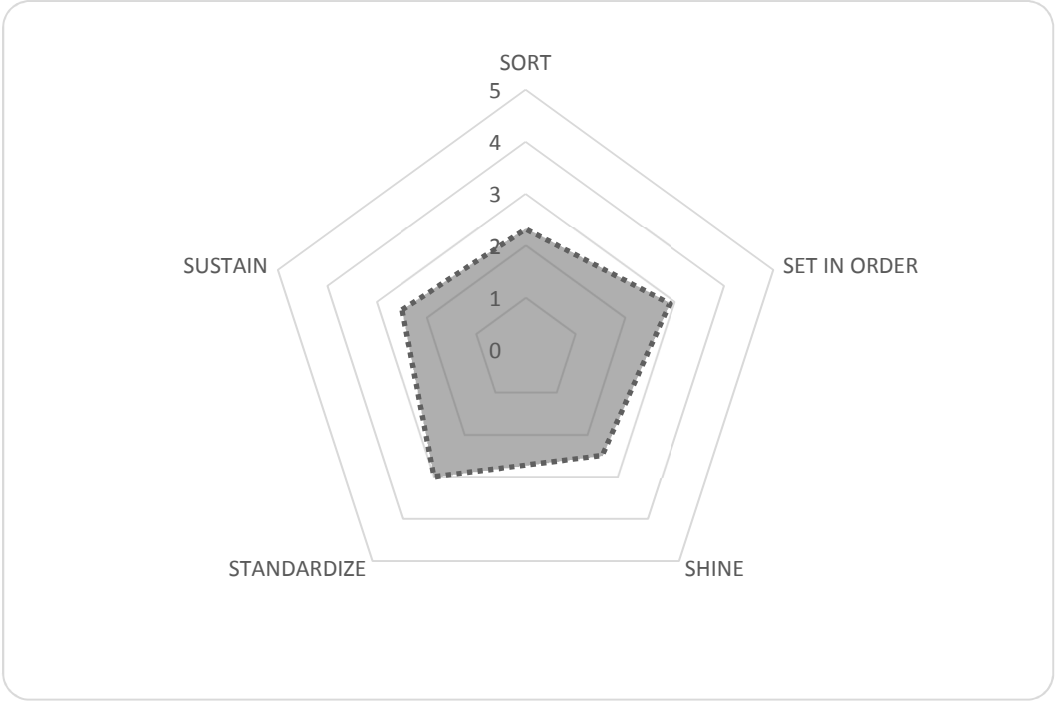
SCORING GUIDELINES

0	**1**	**2**	**3**	**3.5 (4)**	**4.5 (5)**
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**3**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**2**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**

23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**2**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**1**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**3**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

Last Audit Score:	3.6	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	26	44	41	32	10	**153**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.3**	**4.0**	**4.1**	**4.0**	**2.5**	**3.9**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**

10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**4**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**3**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**

26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.

3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.

5S AUDIT CHECKLIST

AREA:	Company C	Audit #	3	DATE:	6-May-15
Last Audit Score:	3.9	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	25	44	41	32	10	**152**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.2**	**4.0**	**4.1**	**4.0**	**2.5**	**3.9**

SCORING GUIDELINES

0	1	2	3	3.5 (4)	4.5 (5)
ZERO EFFORT	SLIGHT EFFORT	MODERATE EFFORT	MINIMUM ACCEPTABLE LEVEL	ABOVE AVERAGE RESULTS	OUTSTANDING RESULTS

	SORT ACTIVITY DESCRIPTIONS	SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**4**
	SET IN ORDER ACTIVITY DESCRIPTIONS	**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**3**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**4**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**3**
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21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
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23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
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STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**

28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**
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32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
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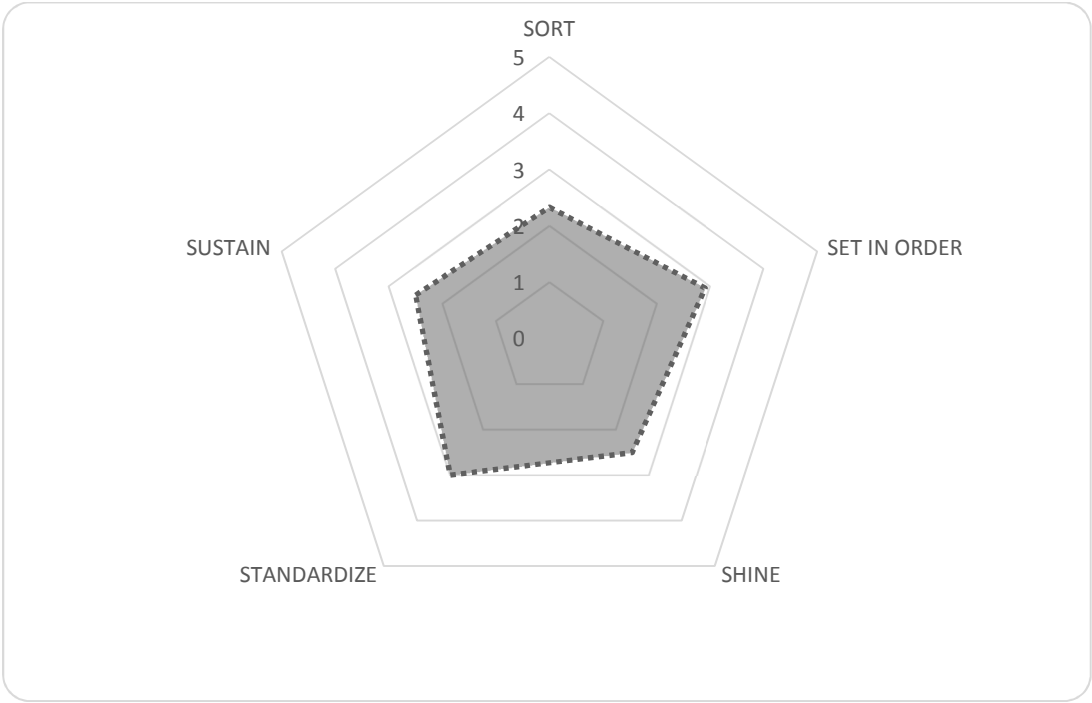


5S AUDIT CHECKLIST

AREA:	Company C	Audit #	3	DATE:	6-May-15
Last Audit Score:	3.9	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	25	46	42	32	10	**155**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.2**	**4.2**	**4.2**	**4.0**	**2.5**	**4.0**

SCORING GUIDELINES

0 ZERO EFFORT	1 SLIGHT EFFORT	2 MODERATE EFFORT	3 MINIMUM ACCEPTABLE LEVEL	3.5 (4) ABOVE AVERAGE RESULTS	4.5 (5) OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**4**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**

9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

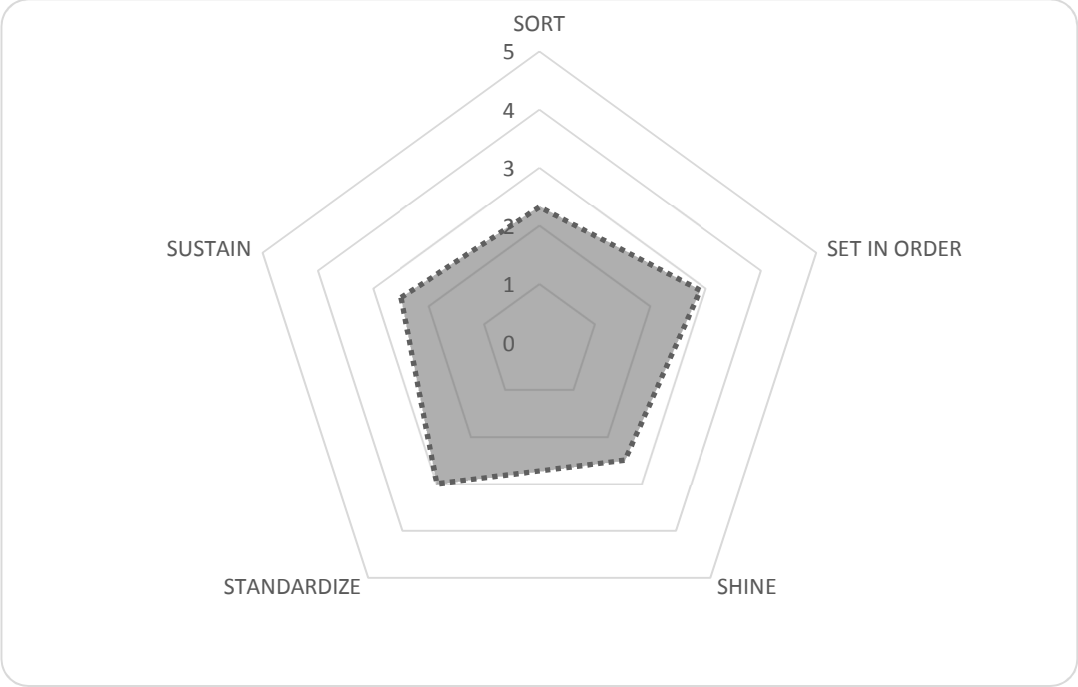
0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**

25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
	STANDARDIZE ACTIVITY DESCRIPTIONS	**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.

3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	5	**DATE:**	6-May-15
Last Audit Score:	4	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	24	46	42	32	10	**154**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.0**	**4.2**	**4.2**	**4.0**	**2.5**	**3.9**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**4**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**

12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

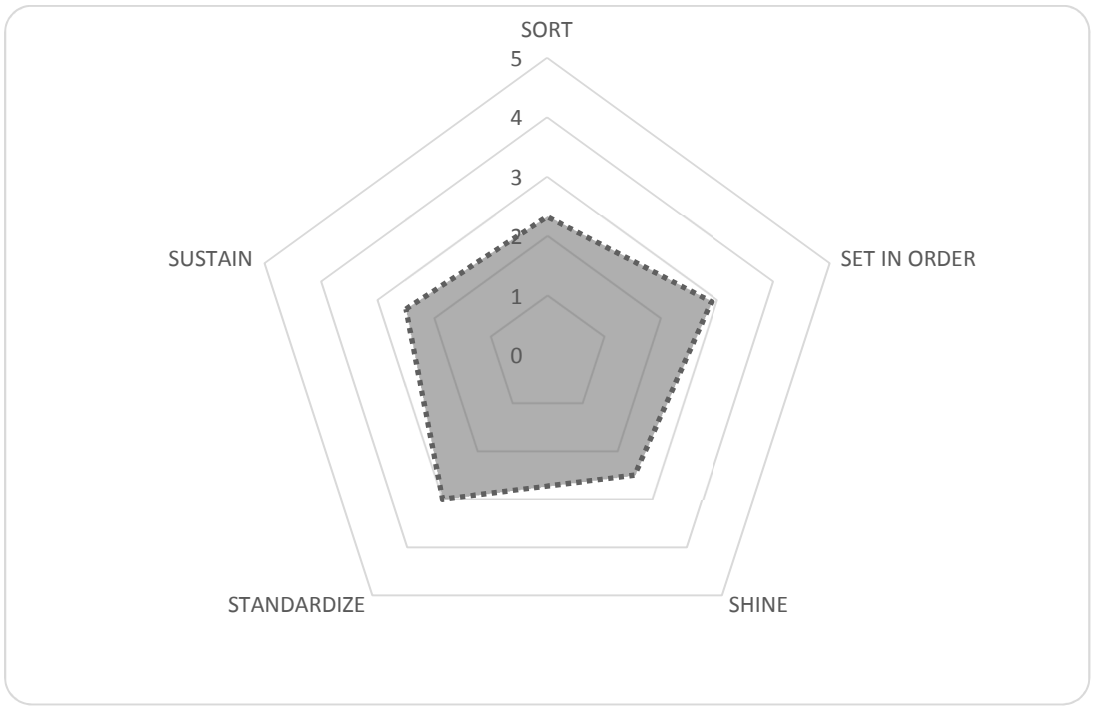
SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**3**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**3**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**

29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.
5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.


SORT
5
4
3
2
1
0
SET IN ORDER
SHINE
STANDARDIZE
SUSTAIN

5S AUDIT CHECKLIST

AREA:	Company C	Audit #	7	DATE:	20-May-15
Last Audit Score:	3.9	Audit by:	Nicole L. Schra-Martin	Next Audit:	

	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score	25	46	42	32	10	**155**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.2**	**4.2**	**4.2**	**4.0**	**2.5**	**4.0**

SCORING GUIDELINES

0 ZERO EFFORT	1 SLIGHT EFFORT	2 MODERATE EFFORT	3 MINIMUM ACCEPTABLE LEVEL	3.5 (4) ABOVE AVERAGE RESULTS	4.5 (5) OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**3**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**3**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**
11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**

12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
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23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
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27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**
28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**

29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**2**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
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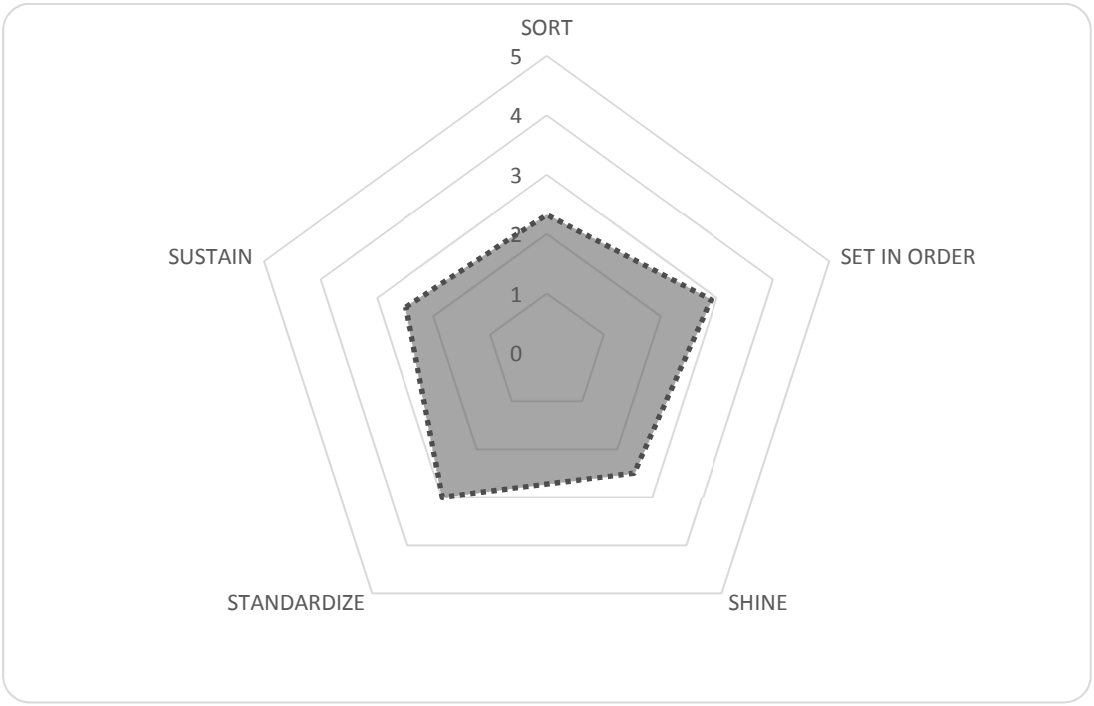
SORT
5
4
3
2
1
0
SET IN ORDER
SHINE
STANDARDIZE
SUSTAIN

5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	7	**DATE:**	5-Jun-15
Last Audit Score:	4	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	26	47	42	32	10	**157**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.3**	**4.3**	**4.2**	**4.0**	**2.5**	**4.0**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
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6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4**
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10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**2**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**3**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
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23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**3**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
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27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**

28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**3**
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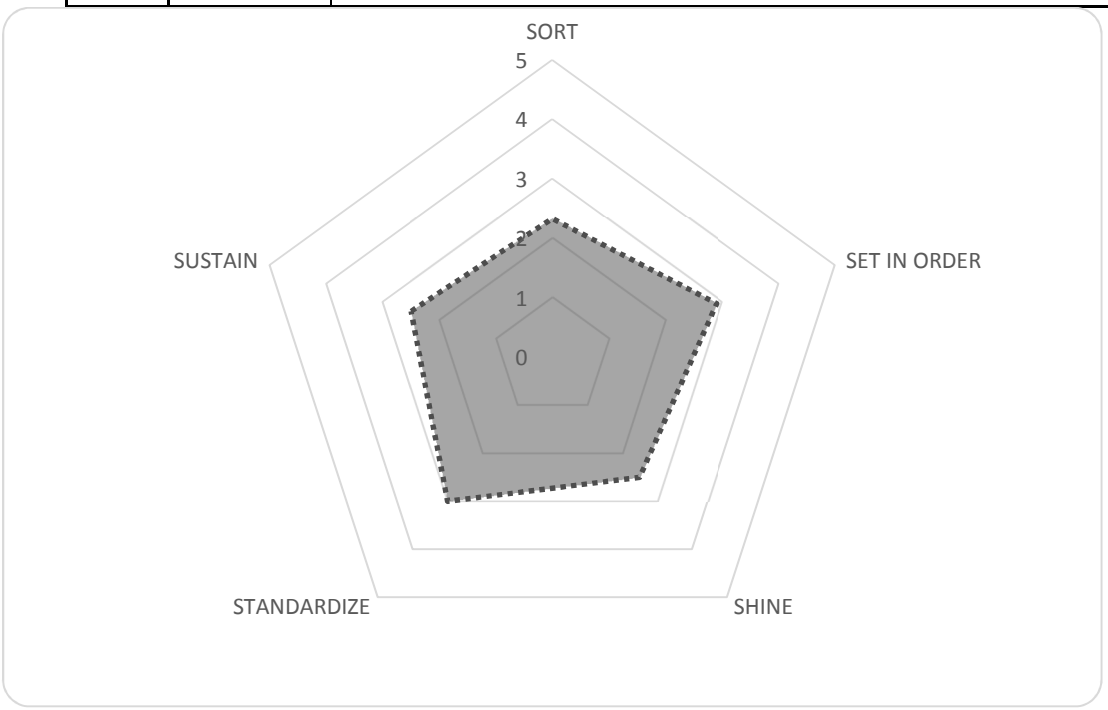
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**0**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**0**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

5	Sustained Outstanding Results	After score of 4.5 on previous audit, a score of 5 may be awarded.



5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	8	**DATE:**	16-Jun-15
Last Audit Score:	4	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	27	50	45	35	16	**173**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.5**	**4.5**	**4.5**	**4.4**	**4.0**	**4.4**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
3)	Only the required **paperwork** is present at the workstation. Out-dated or otherwise unnecessary posters, memos, announcements, reports, etc. are removed from the workplace.	**5**
4)	Only the required **equipment** is present at the workstation. All obsolete, broken or unnecessary equipment, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
5)	Only the required **furniture** is present at the workstation. All broken or unnecessary chairs, shelves, lockers, workbenches, etc. not required to make the current product is removed from the workplace.	**4**
6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4**
8)	**Tools** have a designated storage location that is within reach of the operator. The location is properly labeled and tools can easily be identified if absent.	**4**
9)	**Paperwork** is properly labeled and has a clearly defined and labeled location that is visible to the operators and away from work surfaces.	**5**
10)	**Equipment** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location. Critical maintenance points are clearly marked.	**5**

11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
12)	Work areas requiring **personal protective equipment** are clearly labeled.	**5**
13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
14)	**Fire hoses, fire extinguishers** and other emergency equipment are prominently displayed and are unobstructed.	**5**
15)	Working conditions are **ergonomically friendly**. Tools are stored at appropriate heights, lift assist devices are provided where necessary, etc.	**4**
16)	The **workplace layout** accommodates easy exit in case of emergency.	**4**
17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**4**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SHINE ACTIVITY DESCRIPTIONS		**SCORE**
18)	**Containers, boxes, bins, etc.** are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	**4**
19)	**Tools** are kept clean and in good working order. Where possible, tools are stored in a manner to keep them clean and free from risk of damage.	**4**
20)	**Paperwork** is not torn, kept clean and protected from dirt.	**5**
21)	**Work surfaces** (machines, workbenches, dies, and other equipment including electrical boxes) are clean and painted.	**4**
22)	**Floors** are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	**4**
23)	**Walls, partitions, railings, etc.** are painted and kept clean.	**4**
24)	There is a **schedule** showing times, frequency and responsibilities to clean areas of the workplace such as windows, corners, walls, doors, top of cabinets, etc.	**5**
25)	All **cleaning equipment** is neatly stored and is readily available when needed.	**5**
26)	All **personal protective equipment** is maintained in sanitary and reliable condition and is properly stored in an easily accessible and labeled location when not in use.	**5**
27)	**Equipment safety** concerns are clearly identified. Safety guards are painted, in good working condition and provide adequate protection.	**5**
STANDARDIZE ACTIVITY DESCRIPTIONS		**SCORE**

28)	**Tools, equipment, paperwork, furniture, etc.** are stored neatly in designated areas and are returned immediately after each use.	**4**
29)	**Documents** are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	**5**
30)	Equipment **maintenance records** are visible and clearly state when maintenance last occurred and when next maintenance is scheduled.	**5**
31)	**Product waste** (e.g. shavings, containers, liquids, wrappers, etc.) is consistently and often cleaned up and removed from the workplace.	**4**
32)	**Preventive measures** have been implemented to ensure the workplace meets 5S guidelines (e.g. systems that do not allow waste to accumulate such as containers to collect product debris from machines).	**4**
33)	The **results of the previous audit** are posted and clearly visible to the entire team.	**5**
34)	**Areas for improvement** identified during the previous audit have been completed.	**4**
35)	The **work environment** satisfies the requirements of the work being performed. Lighting (brightness and color), air quality, temperature, etc.	**4**
	SUSTAIN ACTIVITY DESCRIPTIONS	**SCORE**
37)	**Recognition** is given to teams who get involved in 5S activities.	**5**
38)	**Time and resources** are allocated to 5S activities (e.g. designated daily/weekly clean-up time, 5S team leader, etc.)	**5**
39)	All operators, team leaders, supervisors, etc. are assigned **5S activities** to be completed at least once/week.	**5**
40)	The team took the **initiative** to make improvements to the workplace that were ***not*** identified during the last 5S audit.	**1**

SCORE	CATEGORY	DESCRIPTION
0	Zero Effort	There has been no 5S activity in this work area related to this criteria.
1	Slight Effort	Any 5S effort is probably the work of 1-2 people. There is no organized effort and plenty of opportunity for improvement.
2	Moderate Effort	Some attempts have been made to implement 5S, but efforts are temporary and/or superficial.
3	Minimum Acceptable Level	The entire team is working on improving their 5S implementation. Previous improvements are becoming standardized.
3.5	Above Average Results	The level of 5S in the work area is excellent. Although there is still room for improvement, the workplace is becoming world-class.
4	Sustained Above Average Results	After a score of 3.5 on a previous audit, a score of 4 may be awarded.
4.5	Outstanding Results	The level of 5S in the work area is world-class, a showcase for the industry. 5S is fully institutionalized in the workplace.

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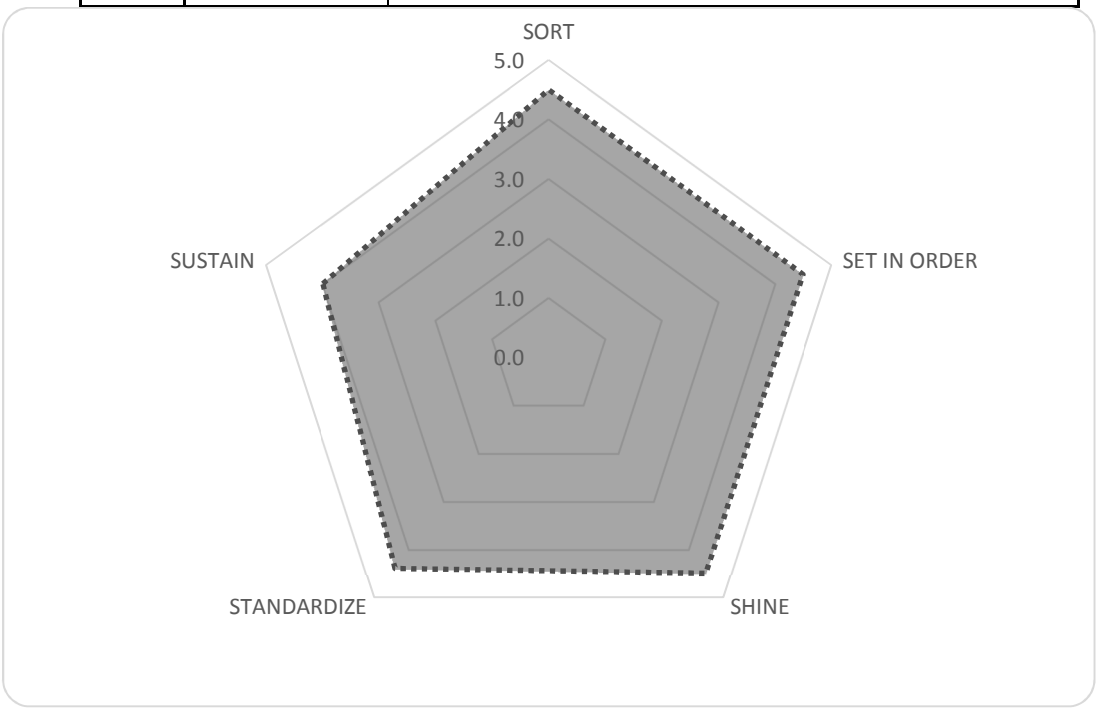

5S AUDIT CHECKLIST

AREA:	Company C	**Audit #**	8	**DATE:**	1-Jul-15
Last Audit Score:	4.4	**Audit by:**	Nicole L. Schra-Martin	**Next Audit:**	

	SORT	**SET IN ORDER**	**SHINE**	**STANDARDIZE**	**SUSTAIN**	**TOTAL**
Total Score	27	50	45	35	18	**175**
# of Questions	6	11	10	8	4	**39**
Average Score	**4.5**	**4.5**	**4.5**	**4.4**	**4.5**	**4.5**

SCORING GUIDELINES

0 ZERO EFFORT	**1** SLIGHT EFFORT	**2** MODERATE EFFORT	**3** MINIMUM ACCEPTABLE LEVEL	**3.5 (4)** ABOVE AVERAGE RESULTS	**4.5 (5)** OUTSTANDING RESULTS

SORT ACTIVITY DESCRIPTIONS		**SCORE**
1)	Only the required **spare parts, materials, WIP, etc.** are present at the workstation. Items not required to make the current product are removed from the workplace.	**5**
2)	Only the required **tools** are present at the workstation. Items not required to make the current product are removed from the workplace.	**4**
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6)	**Tripping dangers** such as electrical cables, etc. are removed from standing/walking areas.	**5**
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
7)	Locations for **containers, boxes, bins, WIP, materials, etc.** is clearly defined by painted lines and properly labeled (part number, quantity, etc.).	**4**
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11)	**Furniture** is clearly identified (numbered, named, color coded, etc.) and placed in a properly identified location.	**5**
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13)	**Stop switches and breakers** are highly visible and located for easy access in case of emergency.	**5**
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17)	**Walkways** and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled and unobstructed.	**4**

SCORING GUIDELINES

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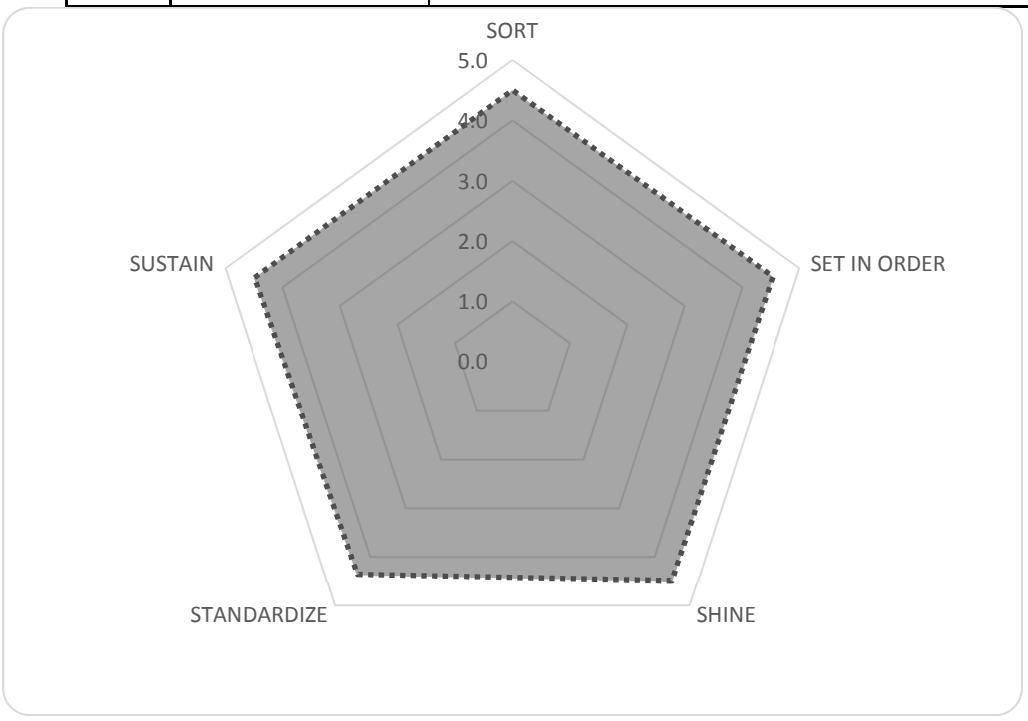

Company C Changeover/Setup Data

Time in minutes and seconds

Machine and fixture changing from to	Pre 5S	Post 5S
A fixture 1 -2	03:23.0	03:20.0
A fixture 2-4	03:01.0	03:23.0
A fixture 4-1	03:20.0	03:17.0
A fixture 1-5	03:15.0	03:18.0
B fixture 8-6	03:15.0	03:12.0
B fixture 6-9	03:01.0	03:15.0
B fixture 9-11	03:24.0	03:23.0
B fixture 11-8	03:32.0	03:15.0
B fixture 8-9	03:19.0	03:34.0